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AVIATION

The Oldest American Aeronautical Magazine

IN THIS ISSUE

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AVIATION

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THE OLDEST AMERICAN AERONAUTICAL MAGAZINE

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GOODRICH SCORES AGAIN!

NEW 50-PASSENGER MARTIN OCEAN TRANSPORT CHRISTENED FOR PAN AMERICAN AIRWAYS — EQUIPPED WITH GOODRICH AIRPLANE PRODUCTS FOR SAFETY

NEW 50-PASSENGER OCEAN TRANSPORT BUILT AND DESIGNED BY THE GLENN L. MARTIN CO.

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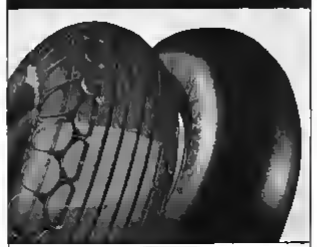
WHENEVER YOU FLY, SEE HOW MANY TIMES YOU TAKE OFF ON GOODRICH AIRPLANE SILVERTOWNS



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G-E Tachometers to Fly the Pacific with Pan American Airways

WHEN she takes off, next month, for her trail-blazing transpacific flight, the *Clipper Pioneer* of Pan American Airways will be equipped with General Electric tachometers, as are all other *Clipper* ships built by the Sikorsky Aircraft Corporation and the Glenn L. Martin Company. General Electric also has supplied all tachometers for the Douglases and Lockheeds of the Pan American fleet.

Investigate the Advantages of This New Tachometer

The new General Electric tachometer operates on generated frequency. As a result, it is gearless and brushless, and has a minimum of moving parts. It maintains high accuracy over long periods of operation, with little maintenance.

A special indicating instrument using a lightweight armature and pointer assembly also contributes to the accuracy and low maintenance of this improved tachometer. A steady pointer is maintained even under conditions of severe vibration. The instrument is easily read because of its open scale.

For further information on this superior, modern tachometer, address General Electric, Dept. 6A-201, Schenectady, N. Y.

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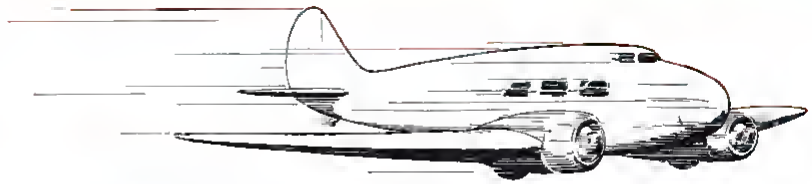
GENERAL ELECTRIC

50% OF U.S. TRANSPORT MILEAGE *flown with New* PENNZOIL



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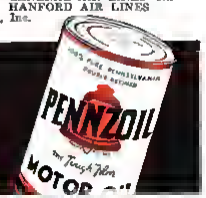
THE TOUGH-FILM OIL THAT TAKES YOU FARTHER, FASTER, AND SAFER



Pacific Preview

Pan American Airways forms a new division

By Daniel Sayre
Assistant Editor of AVIATION

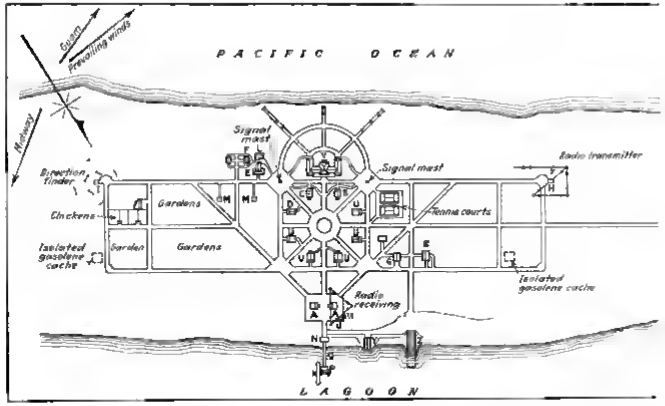
IT IS none too easy, even in retrospect, to pick the most significant aeronautical development in any particular period. Forecasting the aeronautical event of the current year from the meagre vantage point of mid-February would under most circumstances be as prophetically hazardous as attempting to name next year's heavyweight wrestling champion. All of which in no way diminishes our infinite confidence in designating here and now the year 1935 A.D. as the one in all future aeronautical histories to be known principally for the inauguration of scheduled seaplane transport across the world's greatest ocean. It is simply too big a project, too important in its technical, its commercial, its sociological implications to be dwarfed by any conceivable development even in this constantly astounding industry.

AVIATION has in past issues described much of the infinite painstaking development work that forms the background. Some of the immediate general features have recently appeared in the daily press. As the program develops, more will follow. Meanwhile we present here for our readers as much of the plan as can reasonably be published in advance of its actual realization—fragmentary program notes on the coming drama as it is written in the Pan American script, if you will.

The general project

Planted unobtrusively in an introductory paragraph of one of Pan American's traffic estimates for the project is a phrase worth rescuing from prospective oblivion. It might well serve as a motto on the division's insignia. "The Orient," so runs the phrase,

"need not be three weeks away." And indeed it won't be when the new division is underway: a convenient over-night service between San Francisco and Honolulu, a further service from Honolulu to Manila of four daylight flights from Honolulu to Midway, Midway to Wake, Wake to Guam, Guam to Manila respectively; connections with Hong Kong or Canton, with Java, with Japan will put the teeming markets of Asia within a week by air from any part of the United States, and make Hawaii in fact the southwest corner of the country. What the route will mean to the future of our trade relations, our tourist habits, our importance as a world power are generally beyond the scope of this present treatment. Needless to say the potentialities are almost limitless. It takes six to seven days to reach Hawaii from California on the average steamer, fourteen days to Japan, three weeks to Manila, longer to the coast of Asia. Simply from a postal point of view, consider the gain to our commerce from substituting a two weeks mail and reply cycle for the two months it now takes for the average letter to reach China and the answer to return! American industry has been offered no such advantage in the China trade since the days when our sailing clippers dominated the trade routes of the world.



The island of Wake is today an uninhabited coral atoll. Here is a picture of what Pan American will make of it. The letters represent: A—airport offices; B—flight personnel quarters; C—staff quarters; D—airport manager's quarters; E—kitchen and mess hall; F—servants' quarters; G—power house; H—radio transmitter building; I—direction finder and building; J—gasoline pump house; K—servicing building; L—refrigerators and stores; M—windmills; N—shifter dock; O—dock, P—landing float; Q—buoys; R—electric distribution, S—sewerage; T—water collection and distribution; U—personnel houses; V—hotel, X—boat house; Z—ramp

The route

In its bare physical aspects the San Francisco-Hong Kong route can be described as a continental-island stage of 2,410 miles, four inter-island stages of 1,320, 1,260, 1,500, and 1,600 miles respectively, and a final island-continental stage of about 650 miles. One stage, that lying between Honolulu and Midway, is plentifully dotted with small islands. The remainder are almost completely high-seas propositions. The longest, from San Francisco to Honolulu, will lie along the great circle steamer track, a factor of importance for weather study and navigational routine. Again from Manila westward shipping is plentiful.

Meteorologically the entire route from a point a few hundred miles west of the California coast to Guam is dominated by the northeast trade winds and is exceptionally clear of fog and thunderstorms. Aloft the prevailing northeasterlies give way to westerlies or at least lose much of the force that the surface winds would offer in opposition to eastward crossings. West of Guam the weather comes under the domination of the monsoon effects of continental Asia. Occasional typhoons, and cyclonic storms, vary the subtropical monotony, pose problems of forecasting and reporting.

Politically the route all the way to Manila is that dream of world-route projectors, an all-American flag airway. Even at Hong Kong the line will be connecting directly with already established Pan American services. Just why this particular country should have possessed itself in times long prior to the invention of the airplane of a string of island possessions across the Pacific disposed so ideally for airline purposes must remain forever veiled in the mysteries of the forces which control historical destinies. Sufficient be it that politically American they are, and by the development of the airline steadily more and more American should they become in other respects as well.

The bases

Meanwhile American allegiance is almost the only feature common to the various bases. Those at Alameda in San Francisco Bay, at Kaneohe Bay across the island of Oahu from Honolulu, at Manila, and at Hong Kong do have a general similarity in being close to highly developed cities and in requiring only the installation of operating facilities to make them ready for operations. The rest range from Guam with a substantial density of population but limited resources to Midway occupied only by a cable station and its operating crew and Wake which even at this date still is entirely uninhabited.

The mere task of establishing highly efficient stations along such a widely scattered chain of harbors and under such tremendously varied conditions would alone dissuade many an organization from the project. The preparations being made for this phase of the work by the Pan American System would have done credit to any expedition on record. Sometime late in March an airway-construction steamer will head out through the Golden Gate for a four months cruise. On it will have to go a cargo and passenger list as complex an assortment of material and talent as ever loaded a vessel to its Plimsol line, a quarter million gallons of high octane rating gasoline, pumps, tanks and filters; sectional houses for complete permanent colonies at Midway and Wake and for an operating base at Guam all specially designed for tropical comfort, diesel power plants for radio, lighting, pumping and refrigeration, refrigerators, pumps, wind mills, water stills, stoves ovens and kitchen gear; house furnishings, food for six months after landing, tools and seeds for permanent gardens, a cow or two, launches, lighters and dock floats, radio transmitters, receivers and direction finders, masts, antennas and spares; meteorological instruments; septic tanks and plumbing, house wiring, beacon lights, maintenance tools and equipment; medical stores, base managers, radio men, mechanics prepared for permanent residence; engineers, workmen and artisans carefully selected for the versatility and ability for intense continuous labor; a very few executives of the hardy variety. It is indeed a boatload worthy of its high purpose.

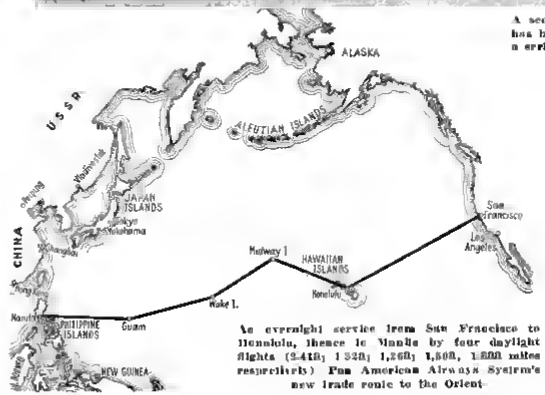
As the ship moves from base to base across the route to Guam and return it will follow a procedure at each harbor as pre-planned as a stage production. At Hawaii so much fuel, so much equipment off, so many gardeners and mess boys and handy men embarked. At Midway and Wake so many days to land so much material, so many hours to set up the diesels, so many to pump and distill a supply of water, so many to prepare the refrigerator to receive so much perishable food from the ship, and so on. Each house, each piece of equipment is lettered and numbered and laid out on a plan like the pieces of a toy village.

By the time the ship returns from its landing at Guam the construction work on Midway and Wake must be finished. Only hotel facilities for passengers resting at night between daylight flights will be still to be erected. What is now but a half dozen points on a map will have become complete and fully manned bases ready for months of full scheduled operation on the world's most remarkable airway.

So much for the problem of the bases. Formidable though it might seem, an estimate of the project made a few years ago would have ranked it at most fourth in order of difficulty of the tasks that stood between the proposal of the service and the flying thereof. More difficult surely has been the development of flying boats capable of negotiating the route with a practical payload, the development of aircraft radio of sufficient range for reliable communication and navigation; and the training of the personnel for an organization which can undertake so ambitious an assignment without fear of failure.

The story of Pan American Airway's flying equipment program has been told

A sectional view of the Sikorsky S-42 Clipper which has been specially equipped and adapted to carry out a series of pioneering flights over the new Pan American Pacific Division.



An overnight service from San Francisco to Honolulu, thence to Manila by four daylight flights (2,448; 1,328; 1,260; 1,500, 1,600 miles respectively). Pan American Airways System's new trade route to the Orient

and retold in AVIATION pages, its bold specifications of unprecedented performance requirements, the equally bold acceptance of the terms by the Sikorsky and Martin factories, the new design features of the resulting boats; their launchings and their test results. At present the first of the Sikorsky S42's is in regular service on Pan American's route to Buenos Aires, a second has been delivered, five more are abuilding at the factory in Bridgeport, Conn. The first Martin 130 is finishing its flight tests at Baltimore. Two others are nearing completion. To the 25-ton Martins will ultimately go the honor of regular Pacific operations, while the 18-ton Sikorskys continue their assignment of the crack Caribbean and East Coast services. This spring, however, is to be a Sikorsky season in Pacific for to the second S42 to be built, christened the Pan American Clipper, has been awarded the task of making the first test runs over the new division.

The Pan American Clipper

Designated a flying laboratory it is to most other airplanes that have been so named as the Bureau of Standards is to the chemical laboratory in a small high school. It is fitted with extra tankage to give it a wide margin of reserve fuel on even the long 2,410-mile flight to Hawaii. It is fitted with elaborate and complete flight instruments, with the latest of radio and navigating equipment, with special hatches for celestial observations, with curtains to permit blind flying practice, with a movie camera to make continuous records of the instrument readings throughout the flights.

It has already covered a number of thousands of miles of practice flights in the Caribbean. Flying it has been a crack crew which will take it soon to Pacific waters, start there extensive tests of engine performance, of the effectiveness of its radio and navigational facilities. Later this same crew will be transferred to the first of Martin Clippers, form the nucleus for a specially trained body of trans-Pacific flying men.

The background of these men and the organization in which they function, the development of the radio and navigational equipment they will be using is a story in its own right. We have treated it in a preceding issue [August, 1934] under the title of "Caribbean Work Shop." Let us say here again, however, that there is no other airline operation in the world better fitted as a training ground for trans-oceanic air transport than the Caribbean and East Coast divisions of Pan American's Latin American Services. Nowhere else are radio demands more severe, maintenance problems more exacting, the necessity for constant meteorological study more real. One hop of the Caribbean service is even of sufficient length to require regular use of celestial and long range directional radio navigation. The rigid standards of personnel selection and training which are obvious requirements of a trans-pacific service can be no greater than those in force on the less spectacular operation. To those familiar with the background the testing flights of the Pioneer Clipper are interesting more for the light they may shed on some of the physical aspects of the route than as demonstrations of general capability of personnel and equipment.

The radio

The radio setup of the Pacific division will be particularly noteworthy. Based on the use of code, on the use of equipment largely designed and built in Pan American laboratories, it represents an extension of the company's major radio policies to new ranges and levels of reliability.

Only major unit of the equipment to be an exception to the rule of Pan American design and manufacture will be the Western Electric, Type 14A, 900 watt, 10 frequency transmitter which will be installed at each operating terminal along the route. On the islands of Midway, Wake and Guam a supplementary 100 watt P.A.A. transmitter will be added. In addition to serving as a standby, the lower powered set will be invaluable for communicating with the planes at short range, for broadcasting periodic radio bearing signals during simultaneous operation of the larger set, and for work with adjacent islands. It will also be used for shore to ship messages while supply ships lie off the coast in the process of lightering their cargoes to shore. The receivers at the bases will be of the latest P.A.A. Type 1496D, specially designed for long range tropical service. The power supply at San Francisco and Manila will be by public utility. At Honolulu public service will be supplemented by a 10 k.w. gasoline generator as a standby. At Midway and Wake where power will be required for pumping, refrigeration and other purposes as well two 35 kw. diesel engines will be set up. At Guam where the loads will be largely from radio two 10 k.w. gasoline engines will suffice.

The antenna system at the bases will consist of three or four receiving antennas immediately adjacent to the radio shelter. Three or four transmitting antennas at a distance of 1,200 ft. in one direction, an improved Adcock direction finding loop system, 1,200 ft. away in another.

On board the planes the same multiplicity of resource is apparent. Two complete and independent antennas, one of the trailing type, one fixed between wing and stabilizer, a third, a mast and its bracing wires serving as an ideal direction finding loop system. Within the radio compartment two 50 watt transmitters, multiple receivers, and direction finding equipment give a flexible and multi-functioned installation.

Preliminary tests of similar shore and plane equipment have shown a marked freedom from night effect, and have consistently given bearings within an accuracy of 3 deg. at ranges from 1,200 to 1,600 miles at frequencies from 6,000 to 250 kilocycles, bearings within 1 deg. accuracy at 250 miles or less.

A miscellany

There are a host of other details we might present to complete our tentative picture.

Col. Clarence M. Young, former assistant secretary of commerce for air, has been named manager of the new division. Commander C. H. Schildauer, formerly assistant operations manager of the Caribbean division, will be operations manager; John C. Leslie, acting division engineer; G. W. Angus, communications superintendent; P. G. Klauck, acting accountant; K. A. Kennedy, acting traffic manager. The flights of the Pan American Clipper will be under direct command of Edwin C. Musick, chief pilot for the entire P.A.A. system.

The tests of the Martin, though held back by ice and inclement weather, have been satisfactory. Final sound proofing and cabin interior details have been settled. Just what disposition will be made of the boats' 14 tons of useful load under actual Pacific operating conditions must await long fuel consumption trials, decisions as to traffic potentialities, reserve margin policies and the like. Tentatively, they are counted on to carry from twelve to eighteen passengers, a ton of mail and a 30 per cent fuel reserve on a Hawaii hop, substantially greater payloads on the shorter western stages.

The calendar

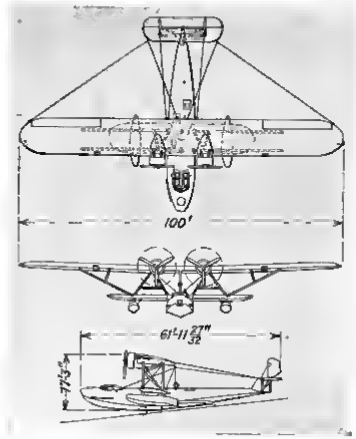
An accurate calendar of the program's progress is obviously an impossibility. Literally hundreds of variables will affect it. The sailing of the supply ship, as we have said, is scheduled for late in March. Within three months from then the bases should be ready along the entire route. Those at Alameda and Kaneohe can be ready much earlier. The Pioneer Clipper's first crossings to Hawaii are likewise definitely a matter of the early spring. The Martins should be ready by early summer. Then more tests, and a long string of various firsts, first passengers, first mail on each of the different stages out and back. Say late summer or early fall for the accomplished fact of full scheduled service, possibly later. Should it take a year or two to build the traffic, organize Asiatic connections, settle to the status of a full trade route, it will still be the achievement of the decade. Shrinking the Pacific to quarter scale is not to be done in a fortnight.

Consolidated P2Y-1

Presenting a detailed description of an important design hitherto withheld through the exigencies of Naval policy

THE Consolidated P2Y-1 is in many of its fundamental features a sesquiplane development of the Commodore monoplane which first established the Consolidated reputation in the giant flyingboat field. Powered with two F Cyclones, it has a normal gross weight, as a Naval patrol plane of 19,980 lb and demonstrated on the mass flight to Hawaii its ability to take off in a nearly dead calm with 24,700 lb. Since its weight empty is but 11,000 lb. and since it attains a top speed of 130 m.p.h. it is obviously a thoroughly worthy inheritor of the older plane's traditions.

The hull is built of extruded aluminum alloy shapes and aluminum alloy sheet. The bottom plating varies from .0625 at the step to .051 at the bow, being .045 aft the first step and .040 aft the second step. The deck plating is .030 throughout. The bottom plating is supported by a system of longitudinal stringers, which are spaced 5½ in. centers, cross-frames, like the stringers of extruded sections, being spaced



at distances varying from 14 to 20 in. A relatively deep keelson extends from bulkhead to bulkhead along the center line of the ship and the inboard edges of the floor frames anchor into it.

The wing spars are extruded aluminum alloy Warren trusses with bulb tee flanges and channel web members. Extruded channel cover plates of various sizes are added to the bulb tees wherever necessary. The ribs are made of rolled flanged aluminum alloy channels with Warren truss diagonals. The connections between rib flanges and rib diagonals are made by means of forged aluminum alloy blocks specially designed to provide universal adaptability to all the types of joint used. The upper leading edge of all the panels is covered with .020 aluminum alloy sheet. The ailerons, which are of the Frise type, consist of a relatively heavy aluminum alloy torque box forward of the hinge point and light ribs aft similar to the wing ribs. They are thus practically statically counter-

weighted without the addition of weight beyond structural requirements. Struts are of aluminum alloy with forged aluminum alloy terminals.

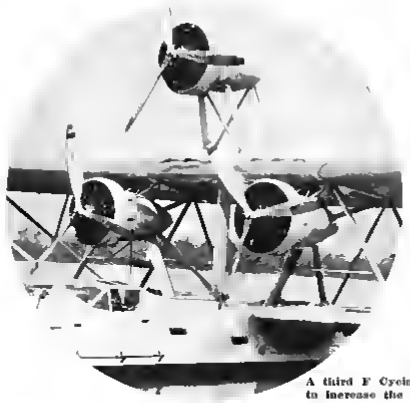
The fuel tanks for normal operations have a combined capacity of 1,200 gal., 700 gal. in two tanks in the upper center section, 500 below in two sidewalk tanks. All the tanks are constructed of .0625 riveted Alclad shells with extruded dural internal trusses, all welding being eliminated.

One of the most interesting features of the P2Y-1 was the provision of an emplacement in the upper center section panel for a third engine. A later design, otherwise similar, the P2Y-3 shown in the three-view drawing on page 83, raises the two engines, but lacks the emplacement feature.

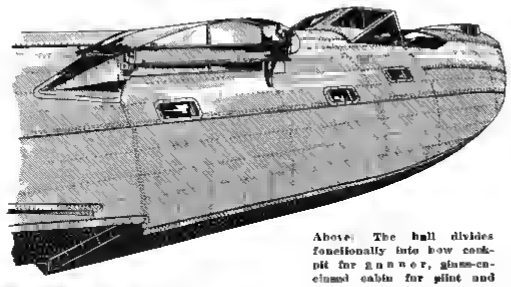
Of the total wing area of 1,430 sq.ft. 1,110 are in the upper wings, 320 in the lower. The ailerons have an area of 110 sq.ft., the stabilizer 79.3 sq.ft., the elevators 62.0 sq.ft., the fins 23.75, the rudders 40.2.

The total empty weight of 11,100 lb. breaks down into wing group 2,948; tail group 297; body group including nacelles 3,172; power plant 3,492; fixed equipment including instruments, controls, furnishing and electrical generators 1,190.

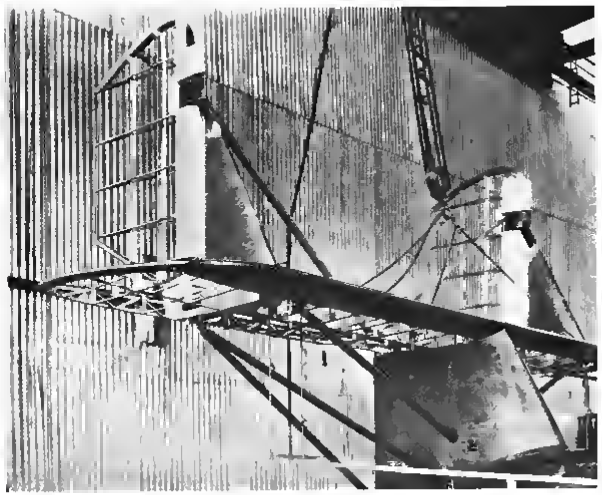
In addition to the top speed of 130 m.p.h. mentioned above, other performance figures given include—stalling speed 61 m.p.h.; initial rate of climb 660 ft. per minute; service ceiling 11,700 ft.; take off (no wind) 39 seconds in a distance of 720 yards.



A third F Cyclone can be mounted to increase the top speed 17 m.p.h.

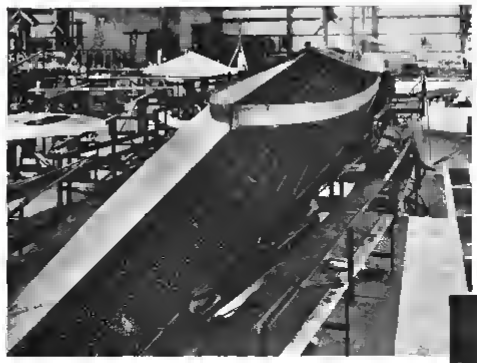


Above: The hull divides functionally into bow cockpit for gunner, glass-enclosed cabin for pilot and assistant, navigator's compartment, mechanic's compartment, radio room, and two rear gunners' positions. Five water-tight bulkheads are provided.



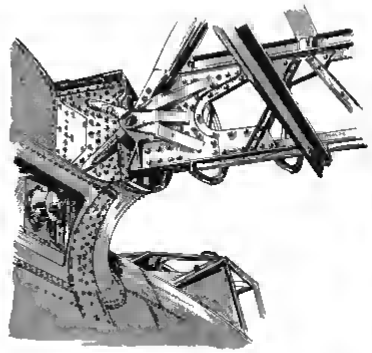
Construction Details of the P2Y-1

Left: The empennage is basically similar to the wing in structure and derives directly from Commodore practice. Elevators and rudders are Frieze balanced.



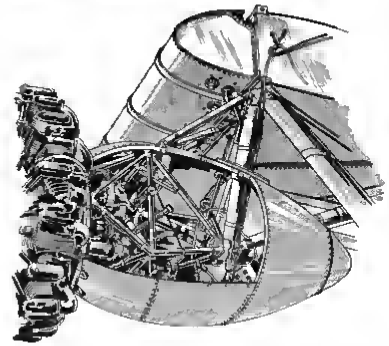
Left: A view of the hull showing the contours of the two steps. At the second step is located a cockpit for a demountable tail wheel which is used in conjunction with a pair of wheels also demountable, for convenient beach handling.

Below: The wing float attachment. Of 4,760 lb. displacement each, the floats are of the same general construction as the hull are divided into three water-tight compartments.



Above: The lower front spar fitting. A welded fabricated steel plate is riveted to the Warren truss-type aluminum alloy spar.

Below: A view of the rear hull compartment showing the framework of extruded aluminum alloy stringers and cross frames. The parachute flare housing is also shown.



The mounts for the Wright F Cyclones of 730-hp. each are of chrome molybdenum tubing and are readily accessible for maintenance and repair work.

Weather's Third Dimension

Another article in a series on the fundamental concepts of the new meteorology. This one introduces the variability of the vertical temperature gradient, its effect on atmospheric mechanics, and instruments used in measuring it.

By Philip Del Vecchio and Daniel Sayre

IN preceding articles we have discussed some of the general characteristics of air masses and of the frontal phenomena which accompany their interaction on one another. There is of course a wealth of detail to be added. Some of it will be considered in future issues. Meanwhile we must pause here for a rather wide discussion of another elementary topic, the vertical distribution of temperature and its general meteorological significance.

The change of temperature with increasing altitude, the *lapse rate* or *vertical temperature gradient* as the meteorologists call it, is one of the most commonly observed phenomena associated with flying. Most pilots have memorized the fact that on the average the temperature falls 3 deg. F. for every thousand feet increase in altitude and have let it go at that. But never was an average so constantly deviated from as this one. Especially in the lower levels the actual rate of temperature drop may be almost twice this figure or the temperature may actually increase with altitude in some layers. Almost never does the temperature fall at a uniform rate for more than a few thousand feet.

Let us take a hypothetical example and assume that at some particular summer dawn we did have a uniform windless air mass with a vertical decrease of temperature with altitude of this uniform average rate.

The temperature-height curve would then be approximately that of AB in the accompanying cut, falling evenly with height, and at a rate of fall of approximately 0.6 deg. C. for every hundred meters.

During the day, as the sun rises higher and higher toward the zenith a first important factor which affects the lapse rate comes into play. This is insolation, the warming effect of the sun's rays upon the ground and the air itself. The ground, being a much better receiver of insolation than air, becomes warmed much more rapidly and to a much greater extent than the air mass itself. By conduction and radiation, however, a great deal of this heat is transferred from the surface to the lower layers of the air and as this process goes on it is evident that the lower portion of the temperature-height curve will assume a position somewhere between AB and CC' in the figure. In other words the lapse rate has been changed considerably by this warming and has become very high in the lower part of the curve.

Toward sunset, as the factor of insolation begins to lose its importance, the curve again gradually approaches its original shape, that represented by AB. Some time in the evening, it is once more close to the average rate. From then on, however, another process begins which alters the temperature-height curve in the opposite direction. The radiation which has begun during the day from the earth's surface to the air layers and outer space continues during the night until the surface is markedly cooler than the air above it which results in a temperature curve somewhere between AB and EE'.

It will be noticed, now, that due to this much more rapid cooling at the surface and in the lowest layers the temperature has fallen so rapidly at these points that the lower curve actually shows an increase of temperature with height instead of the usual decrease. This is called a *temperature inversion*.

Prime variable

And so it goes. Obviously the effect of the insolation on the lapse rate will vary with the season, with the general characteristics of the air mass involved, with the amount of cloudiness, with the velocity of the wind, and with the nature of the earth's surface. At higher altitudes the presence of any overlying air masses different in character from the one at the surface would be reflected in discontinuities in the lapse rate. Any general lifting or subsidence of the mass such as might be caused by mechanical lifting over a mountain range or another mass will also affect the temperature-altitude relations within it. The lapse rate then at any particular time or place may lie between wide limits. That it is so variable and yet is so important to a number of meteorological phenomena must be counted one explanation of the endless permutations and combinations observable in our weather.

Dr. Karl Knapp (left), director of Upper Air Research for the Massachusetts Institute of Technology, discusses the meteorographic record of an airplane sounding with Daniel Sayre, formerly one of the Institute's research pilots

Chief effect of the prevalent lapse rate upon atmospheric mechanics is its control of vertical movements. We must go back here and define adiabatic process. Adiabatic process with respect to meteorology is one in which an isolated portion of air may be lifted or depressed from its original position in the atmosphere without loss or gain of heat. For instance a mass which is started from the surface of the earth and lifted to five thousand feet will expand against the decreased pressure and will occupy more space, but if there is no loss of heat in the lifting, it is said to have undergone an adiabatic expansion. This does not mean that the air in question does not drop in temperature—it most certainly does to satisfy a prime law of physics—but there is no heat lost and no heat gained from the surrounding atmosphere. Moreover, with this limiting assumption (highly accurate for most processes in the actual atmosphere) the rate of its cooling is easily determined. For dry air or air not close to saturation it is within a few per cent of 1 deg. C. for every 100 meters of altitude.

Stability

This adiabatic lapse rate is represented in the figure by the lines AG, EH and CD. If we now refer to the part of the curve under consideration in the foregoing paragraphs as EE' we shall see that if a portion of air were forced to rise, it would cool at the rate of 1 deg. C. per hundred meters and that it would follow the adiabatic curve EH. A little closer inspection will show that as this air rises adiabatically, it will be always colder than its surroundings as indicted by the right temperature curve EE'F. If the process of mechanical lifting is not carried on forcibly, it will be seen that the air mass must fall back again to its original position by virtue of its greater weight and density, volume for volume. The air in this case is said to be *stable*.

However, if the same process occurred during the afternoon and a portion of air began its rise at C it will be seen that if it followed the adiabatic curve CD it would be always warmer at any point than its surroundings as indicated by CC'D, and being always warmer would continue to ascend by virtue of its being lighter and less dense than its surroundings. This air would be called *unstable*.

To put it in another form, if the lapse rate prevalent in any unsaturated layer of the atmosphere is 1 deg. C. per hundred meters or more, any upward motion of air started within it will continue until the air in motion has reached at least to the top of the layer. If the prevalent lapse rate is less steep than this rate any upward motion will be quickly damped out.

Knowledge of the lapse rate in the atmosphere above a point, especially if it is accompanied by a corresponding curve of the humidity present at each level, will give then, an excellent indication of the immediate weather potentialities (a steep unstable lapse rate would indicate a possibility of strong convection currents, cloud formation, rain, thunderstorms; a slow stable lapse rate a freedom from such tendencies). Moreover, a marked discontinuity at a comparatively high altitude would indicate the presence of an overrunning mass of tropical air, possibly the approach of a warm front with its characteristic phenomena. And so on.

In our first article we mentioned the desirability of airplane soundings for general air mass identification. But even without the general air mass concept they would be worth while for this immediate knowledge they give us. Let us study briefly the modern technique of making such soundings.

Airplane soundings

Upper air soundings were first made with manned-balloons, unmanned-balloons or kites. On the earliest manned-balloon explorations periodic simultaneous readings were made by the balloonist of atmospheric pressure, temperature and relative humidity as they were indicated by an ordinary mercury barometer, and wet and dry bulb thermometers.

Exploration by unmanned-balloon or kite required the development of the *meteorograph*, an automatically and continuously recording combination of thermometer, barometer, and hygrometer (humidity indicator). Its resulting record, usually a set of curves traced on a smoked drum, gives an immediate indication of the three principal meteorological elements for each instant of the ascension.

Substantially the airplane meteorograph of today is but a refinement of the earlier models developed for balloon and kite use.

The temperature indicating unit, a bimetallic strip similar to those used frequently in thermostats, the humidity indicator, a number of hairs stretched between uprights, and an aneroid barometer are mounted on a light frame and connected through suitable mechanisms to three metallic fingers which bear against a clockwork rotated cylinder. In some instruments an inked trace is made by each finger on a paper card which is mounted on the cylinder. In others the trace is made on the smoked surface of a piece of lead foil. The working parts

Inserting the meteorograph in its case before a sounding. Fully automatic it will make a record of the temperature, pressure, and relative humidity for each instant of the flight's duration

in the frame are designed to slip into a light and usually partially streamlined case suspended from the wing structure with shock cords or some other vibration damping device Many meteorographs are further equipped with an electrically actuated fourth finger or stylus Connected to a push button in the pilots cockpit it marks accurately on the record the location of various visual observations of cloud levels, haze lines, bumpiness, and the like with which the pilot supplements the instrumental record.

It is not the least troublesome instrument that was ever carried aloft by any means. It must be kept constantly calibrated It is never entirely proof against absent minded failure to wind it, or set it going Its humidity readings are not as accurate as could be desired under certain conditions. The process of transferring the values of each point on a set of spider like lines on a smoked drum into values of temperature and humidity for each altitude requires a deal of mechanical work with scale and dividers, some manipulation of tables, and the use of a special type of plotting paper Since the flight results are generally desired for immediate use by the forecasters this necessary outlay of effort and time is unfortunate In general it means that the flight must be completed at some considerable time in advance of the routine surface observations which it is to supplement

But despite its faults it cannot be denied that the meteorograph has been a tremendously useful and albeit to date sufficiently accurate means of increasing our upper air knowledge

At more than twenty stations in the United States alone such instruments are carried daily on soundings to heights of from 16,300 ft. (5 kilometers) to 20,000 ft Scheduled to be available in completed form for the morning forecast they have so far been but an early morning feature Air mass proponents would like twice the number on at least a twice daily schedule. As the present excellent cooperation between the Weather Bureau, Navy, and Air Corps (each operates about a third of the present stations) continues perhaps they will eventually get them.

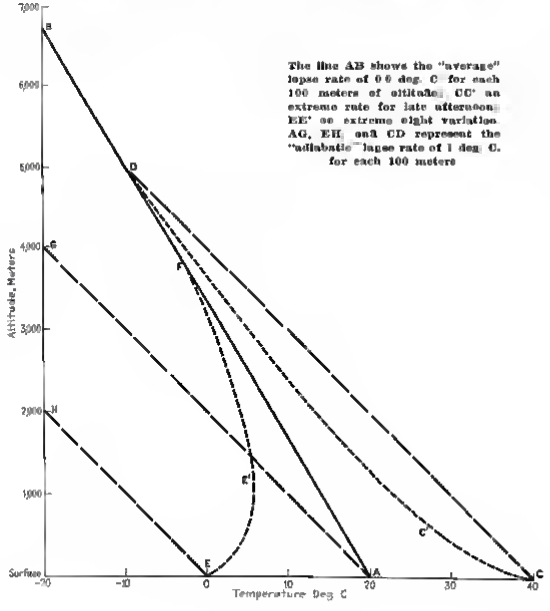
Flight technique

The flight technique required for airplane sounding work is rather beyond the topical limits we have set ourselves for this series. During clear weather it is generally similar to that required on the way to and from a job of high scale mapping In difficult weather, and it is obviously at least as important to gather the data during bad weather as it is to do so on clear days, the flights can require as much blind flying equipment and technique as the toughest of mail assignments Encounters with ice are more frequent than in any other type of work, for on other assignments ice can be frequently avoided by remaining below certain altitudes Circling a point or at least patrolling a small fixed area is not always the simplest of navigation problems, even with radio Oxygen is really a necessity for daily repeated flights above 15,000 ft. But we were not going to discuss this here.

Meanwhile for these twenty points we have a definite means of identifying the overlying air masses, and determining the lapse rates prevailing in different layers under early morning conditions Added to the data secured from a great number of airway stations on wind velocities aloft, added to direct reports from airplanes in flight, added to a slow accumulation of data from stratosphere balloon soundings they are beginning to yield an ever more complete picture of American air mass action

Forced for half a century to manipulate an extremely three dimensional science with two dimensional data the task done by the meteorologists to date has been truly remarkable With extended data the possibilities for the future are almost limitless

In our next article we shall take up several specific examples of soundings, and follow through the process of utilizing the data they embody from the determination of temperatures and relative humidity for each altitude from the meteorograph traces, through the resulting "adiabatic" chart, to the final "Rossby" diagram on which the individual air masses involved can be studied in terms of their conservative properties



The line AB shows the "average" lapse rate of 0.6 deg. C for each 100 meters of altitude. CC' an extreme rate for late afternoon. EE' an extreme night variation. AG, EH, and CD represent the "adiabatic" lapse rate of 1 deg. C. for each 100 meters

Weather stations

Meanwhile for those whose specific interest in the subject is accompanied by an opportunity to visit one of the following stations we would very highly recommend making a personal contact with the equipment and technique involved It has ever been our experience that anyone with a legitimate interest in meteorology (and whose is more real than the airman's) is a welcome and considered guest at any Weather Bureau or Service Station, provided only that the visiting is not allowed to coincide with one of those peaks of work which occur throughout the meteorological day Certainly a few minutes direct explanation and study of the instrument and the plotting is more effective than a dozen articles could be.

These stations are operated entirely by the Weather Bureau: Murfreesboro, Tenn.; Houston, Texas; Oklahoma City, Okla.; Omaha, Neb.; Fargo, N. D.; Cheyenne, Wyo.; Billings, Mont.

These by the Naval Air Service: Anacostia, D. C., Lakehurst, N. J.; Norfolk, Va.; Pensacola, Fla.; Seattle, Wash.; Oakland, Cal.; San Diego, Cal.

These by the Air Corps: Boston, Mass. (with M.I.T.), Mitchell Field, N. Y.; Detroit, Mich.; Dayton, Ohio; St. Louis, Mo.; Montgomery, Ala.; San Antonio, Tex.; Spokane, Wash.

Economic Engine Operation for Cruising Reliability

The factors contributing to cruising reliability are numerous and not all of them can be controlled A beginning has been made in the analysis of the problem, however, and a study of the influence of some of them is presented in this article, the twelfth of a series on operation at desired cruising conditions.

By Edmund T. Allen and W. Balley Oswald

THE ENGINE is the heart of the airplane. Cruising airplane performance can never be specified until cruising engine performance is known. Just as in the tempo of modern life, the determining factor is often how much the heart will stand, so on an air transport line we can often point to an unintelligent schedule or operating technique which cannot be maintained without too wasteful a record of engine breakage, fuel costs, airplane crashes and loss of human life. The analysis of aircraft operation, however, has the advantage over analyses of human stress and strain in that it is yielding cold quantitative data, whereas we are still too often guessing in the field of life-tempo, with always an emotional weighting of the factors of advantages versus costliness in accordance with individual values and philosophy.

Any introduction to the study of aircraft engine operation should contain a definition of the criteria to be used in judging the advantages and disadvantages of a high-tempo "Engine reliability" is a term of vague connotation requiring not only to be simply defined but to be described in units of engine-failures, of modes of operation affecting reliability, of resulting interruptions in scheduled departures or arrivals, of costs of replacements

Engine failures are sometimes limited in statistical data to a stoppage resulting in a forced landing; sometimes the term refers to breakage of an engine part; sometimes, with multi engined aircraft which continue to their regular destination after an engine failure, it applies only to those failures which cannot be quickly repaired or which require a new airplane substituted for the one which has had the engine failure. Often statistical engine failure includes stoppage due to running out of fuel, then again to such causes as running low on oil with consequent loss in oil pressure and the necessary shutting down of an engine to prevent damaging it.

For the purpose of this study engine failure will be defined as any engine difficulty, aside from fuel system troubles, resulting in either a forced landing or a ten minute delay beyond regular take-off time from a scheduled stopping point. This arbitrary definition coincides approximately with the Bureau of Air Commerce definitions and permits using data available on some airlines.

In a former article (AVIATION, April, 1934) an analysis was made of cruising power output and other engine limitations as factors equally influencing reliability. Expressed in terms of engine-miles per engine failure, 300,000 such units may be taken to represent roughly an operation in which the maintenance of a fast schedule is paramount, and in which 75 per cent of rated power may be utilized during cruising flight (since that article appeared this has been reduced to 70 per cent on some airlines) Where double this reliability is desired, 600,000 engine-miles per engine failure may roughly be said to result from a reduction of cruising power to 55 per cent or 60 per cent of the rated power of the engines.

Reliability	Cruising Limits
300,000 engine-miles per engine failure	70 to 75 per cent power output.
600,000 engine-miles per engine failure.	55 to 60 per cent power output.

These reliability figures in engine-miles per engine failure apply to airplanes having level-cruising velocities of approximately 200 m.p.h. at 75 per cent power and 180 m.p.h. at 60 per cent power The reliability figures in engine-hours per engine failure are then: 1,500 hours per engine failure at 70 per cent to 75 per cent power output, and 3,300 hours per engine failure at 55 per cent to 60 per cent power output When cruising velocities at given powers differ appreciably from those cited, the number of engine-failures per mile must be modified correspondingly to maintain the same number of hours per engine failure.

Engine power output is, however, not the only factor determining reliability. The engine-revolutions (r.p.m.) and mean effective pressure (b.m.e.p.) at which this power is obtained are equally important. Intake or supercharger manifold pressure, usually referred to simply as manifold pressure, is the pilot's guide to b.m.e.p. and it is this which the pilot controls with his throttle In order to achieve the desired reliability obtainable by cruising at a limiting power of from 70 per cent to 75 per cent, it is essential that engine revolutions also be limited.

The determination of this limit has been the result of both a practical survey of airline operating experience together with block tests at various ratios of revolutions and manifold pressures, and a theoretical analysis of principal engine stresses resulting from the somewhat opposing explosion-loads and centrifugal-loads. If, in pursuing this analysis, we plot as in Fig. 61, for constant cruising power at varying crankshaft r.p.m., the principal factors which might affect reliability, we will note that for the Wright Cyclone F3, the main bearing loads, both maximum and mean, and the cam-follower load favor the 1,900 r.p.m. end of the range

investigated while the crankpin loads and exhaust valve seating velocity favor the 1,500 r p m end of the range. With the Cyclone's oversize crankpins the maximum load of 19,000 lb and the mean load of 16,000 lb for cruising at 500 b.hp result in very low unit pressures and are not critical for this engine. The exhaust valve seating velocity of 1.5 ft per second is also low and does not constitute a critical condition. The factors which are high for low r.p.m. at cruising power heavily weight the balance in favor of higher cruising revolutions. This weighting is confirmed by operating experience. This is true not only for the higher cruising power operation, but also for the double reliability operation at lower cruising power, where it is essential that cruising revolutions be maintained at a point giving optimum conditions in the engine for that power. If we could plot engine failures as a function of r.p.m. for constant cruising power we would see a minimum liability to engine failure occurring at some intermediate value of revolutions with an increasing liability to failure at both lower and higher r.p.m. In fact, reliability may be better at a higher power at the proper r.p.m. than at a lower power output at an unfavorable value of the r.p.m. Curves illustrating the variation of reliability with r.p.m. are given in Fig. 62. The line representing engine failures at 55 per cent to 60 per cent power would have its minimum number of engine failures occurring at a lower value of r.p.m. than the 70-75 per cent power line. On the Wright Cyclone F3 these minima would occur at 1,880 and 1,810 for the higher and lower cruising powers. On the P&W. Hornet SDG they would occur at 1,900 and 1,850.

Each engine design is individual and has different factors of importance and non importance. The Hornet SDG, for example, seems to have its optimum cruising revolutions occurring at a higher value but at a somewhat lower percentage of its rated revolutions than the Cyclone.

Our tabulation of limitations should now be amended as follows:

Reliability	Cruising Limits
200,000 engine miles per engine failure	70 to 75 per cent power output. 1 880 r p m (Wright) 1 900 r p.m. (Hornet)
500 000 engine-miles per engine failure.	55 to 60 per cent power output. 1 810 r p m (Wright) 1 850 r p m (Hornet)

In cruising level flight at constant power and constant propeller pitch the r.p.m. for any density will be constant. As altitude is increased, engine-revolutions will increase (see Fig. 55, AVIATION, February, 1935). Thus on the DC-2 with propeller design No. 6111 set at 34.5 deg. 70 per cent power output occurs in cruising level flight at 4,000 ft., density altitude at 1,650 r.p.m. and approximately 30 in. Hg. manifold pressure. Resetting the propeller pitch 3 deg. down to 31.5 deg. will result in 70 per cent power output occurring at this same altitude at 1 790 r p m and approximately 29 in. Hg. m.p. The latter propeller setting is to be preferred for this 70 per cent power operation at this altitude since the revolutions are nearer to the ideal revolutions for this power. This low setting would not be preferred for high-altitude cruising at high cruising power because engine-revolutions would be too high under these conditions. Some compromise setting is preferable for low-power cruising, for low-altitude cruising, or for extremely low temperatures, any of which decrease cruising engine-revolutions below the recorded values. Some lower propeller pitch setting than that for optimum cruising altitude may be preferred for a reason connected with manifold pressure limits.

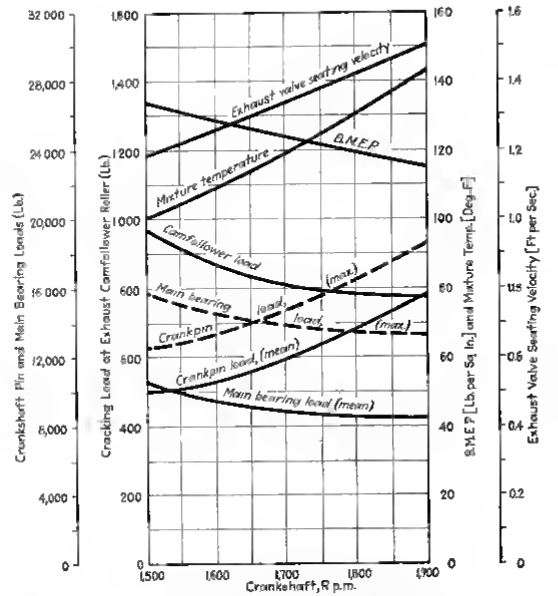


Fig. 61. Principal factors affecting engine reliability vs. r.p.m. (Wright Cyclone "F" engine at 500 hp equals 70 per cent power.)

Importance of manifold pressure

Manifold pressure, as an indicator of b.m.e.p., must be controlled more carefully than engine-revolutions. Bearing in mind that we are still referring to *constant-power* changes in r p m and m.p. we should find, if we constructed a minimum-failure chart vs. m.p. for our two cruising powers, that m.p. for best reliability has quite as sharp minima as r.p.m. For the Wright Cyclone F3 these minima occur at m.p. of 28.5 in. for 70 per cent, and 28 in. for 60 per cent cruising power. We are now in a position to add these m.p. limits to our tabulation of limitations, and we may at the same time add also certain other factors affecting engine-reliability and wear, such as oil temperatures, carburetor air temperatures, mixture controls, etc.

During the other operations like take-off, climb and descent, these cruising limits may have to be exceeded for short periods of time. It is time of operation under a given stress which is the determining factor in setting the limit for the stress. Thus for take-off which lasts approximately ½ to ¾ of 1 per cent of the time of each flight a manifold pressure of up to 37 in. Hg. is permitted, and engine revolutions of 2,050 would be allowed. Take-off power output may likewise exceed the 70 per cent cruising limit with an allowable 105 per cent of rated power for the take-off run. The double reliability values of these factors for take-off are 100 per cent power—2,050 r p m. and 36 in. m.p. An analysis of the various

operations of an airliner with the time required for each indicates that on average airline schedules level cruising occupies roughly 50 per cent of the total stressed time, descent 30 per cent, climb 15 per cent, initial, higher powered, climb 2 per cent, running up the engines on the ground and taxiing 2 per cent, and take-off a little less than 1 per cent. On the basis of these times taken together with the necessities for practical operation, the complete tabulation of operating limits may now be essayed.

We may substitute other criteria for reliability even though they too are at best judicious estimates of tendencies. Wear can be taken as such a criterion, with length of time between overhauls, cost of replacements and/or total life of the engines as factors. Fuel and oil consumption are obliquely related to this factor of heavy duty vs. light duty, but they are only part-factors and must be combined with other costs resulting from heavy or light use of equipment before a useful criterion may be made of them. The beginning has been here indicated for a more exact study of the costs vs. the advantages of using aircraft engines up to the limit of their cruising potentialities.

Operating controls

There are several operating controls which have a direct and important bearing upon reliability. These are the three temperature controls and the mixture control. Cylinder head and base temperatures are of utmost concern since they are direct indicators of unsatisfactory conditions within the engine. There is, on some airplanes, an independent control of cylinder cooling through cooling flaps or shutters or the use of forced draft cooling. In a take-off or climb at low forward speed with high power output and often high cooling air temperature, there is sometimes required an increase in the flow of air which would normally pass over the cooling fins. At high forward speed such as in cruising flights, and in cold air, it may be necessary to cut down the flow of cooling air in order to maintain a satisfactorily high cylinder temperature. Where, however, there are no adjustments of this air flow, the temperatures must be watched and kept below the specified limits, if necessary, by throttling. Should the piston rings or valves start giving trouble or should there be incipient detonation, cylinder temperatures will often be the first indicators of this trouble. Continued operation in disregard of this warning will sacrifice reliability.

Guarding against detonation

Detonation is the most serious possibility which must be guarded against. Cylinder temperatures are not always a safe guide here since finning has become so efficient that satisfactory cooling may be occurring simultaneously with incipient detonation which will damage the engine. On most installations there is but a single thermocouple per engine on account of the difficulty of having a multiplicity of galvanometers or an elaborate switch. Incipient detonation usually occurs in only one or two cylinders on account of faulty distribution. The thermocouple has been placed on the cylinder usually found to be the hottest in a climb. This may not be the one in which detonation is occurring. If a simple, light thermocouple installation could be devised which would read only the maximum value of nine points—one on each cylinder—airplanes would be much better protected against one of their greatest enemies namely detonation.

The modern transport pilot has two other temperature controls which affect engine reliability. These are the controls for oil temperature and carburetor air temperature. Oil temperature should be maintained at 150 deg. F. for cruising. This is contrary to earlier transport practice which preferred keeping the oil under 100 deg. F. The higher value has been found to reduce wear. Higher values than 150 deg. F. would be even more desirable were it not for the fact that oil consumption—or rather oil wastage—increases rapidly as the oil viscosity drops beyond 150 deg. F.

Carburetor air temperature

Carburetor air temperature is a relatively new control which originated with the attempt to combat carburetor icing. The hot spot and carburetor preheating are two ways in which this and the distribution problems have been tackled. Sometimes both the hot spot and the preheater are used simultaneously. Some air transport lines are now requiring that a preheater be installed sufficiently large to raise the temperature at least 100 deg. F. above outside air temperature and even this may not be sufficient protection against carburetor icing under extreme conditions.

Tabulation of Limitations

	Power (Per Cent)	R.p.m.	Manifold Pressure (Inches)	Carburetor Air Temperature	Oil Temperature	Mixture Control	Head Temperature
Overhaul periods short, replacements heavy. 000 000 engine miles per engine failure*							
Cruising limits	70–75	1 850–1 900	28.5–30.0	100	150	avoid lean	500
Normal climb	80	1 950	32.0	100	150	avoid lean	500
Initial climb	90	2,000	34.5	100	150	rich	530
Take off and emergency	105	2 050	37.0	100	200	rich	530
Descent	75	1 925	28.5	100	150	avoid lean	500
Overhaul periods long, replacements small. 000,000 engine-miles per engine failure*							
Cruising limits	55–60	1 790–1 830	28.0	100	150	avoid lean	500
Normal climb	80	1 950	32.0	100	150	avoid lean	500
Initial climb	90	2,000	34.5	100	150	rich	530
Take off and emergency	100	2 050	36.0	100	200	rich	530
Descent	60	1 900	28.0	100	150	avoid lean	500

*If no operation at detonating conditions and no operation at rough periods.

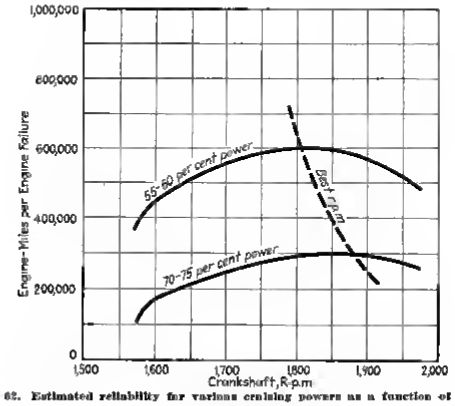


Fig. 62. Estimated reliability for various cruising powers as a function of engine revolutions.

With such preheating possibilities the question arises: What effect does the preheat have upon power and reliability? The power decrease with air temperature increase is known to be approximately 1 per cent per 10 deg. F. increase in temperature. This "loss" of power is of little concern to the transport operator or pilot because he has available more power than he can use at his chosen reliability. Seventy per cent of rated power is obtainable, even though 10 per cent is "lost" in preheating, simply by opening the throttle slightly to recover the proper engine revolutions.

The effect of preheat upon reliability is not so simple as its effect upon power. Reliability is affected in two ways by preheat: (1) If distribution is uneven between the cylinders, application of preheat will smooth out this unevenness. Thus if two or three cylinders are running dangerously lean and the remainder are rich, preheat will tend to richen up the lean ones and lean out the rich ones. Average cylinder head temperatures will probably rise but the temperature of the leanest cylinder will be lowered. The single thermocouple may show this lowering if it is on the leanest cylinder, but if it is on one of the richer cylinders it will probably show a rise in temperature. (2) If, owing to differences in blower design and cylinder design, detonation is a problem rather than faulty distribution, then the application of preheat to the carburetor air intake may increase the tendency to detonation because this tendency is proportional to the temperature of the charge. Eighty-seven octane fuel may detonate in a normal compression engine at cruising power if the carburetor air temperature is excessively high, and cylinder temperatures are high and the mixture is too lean. This tendency to detonate at cruising power is more marked on some engines than on others owing to cylinder design variations. It cannot always be predicted. The safest guide in the application of preheat to prevent icing, improve distribution if needed, and avoid aiding a detonating tendency, is: (1) to install the carburetor air temperature gage in the passage beyond the carburetor where the temperature can be maintained just above freezing, (2) to watch exhaust for evidence of faulty distribution; (3) to throttle to lower power whenever using excessive preheat. Incipient detonation can often be detected by watching at night the nature of the exhaust, but an engine expert might be needed to point out the salient features of such an indicator.

Mixture control

Mixture control is another of the operating controls which has a direct and important bearing upon reliability. It is, in fact, so important that even though all other controls were operated in the most conservative manner possible, a pilot who does not use the mixture control properly may easily have five times the number of engine failures called for in the schedule. The fact that less than 50 per cent of the pilots on some airlines have over 50 per cent of the mechanical failures can largely be accounted for by individual differences in method of mixture control operation.

The mixture control is very difficult to operate because it is extremely sensitive to slight differences in jet sizes and float levels, and because the indicators of "correct" mixture are not positive enough. To illustrate how sensitive the mixture is it may be pointed out that a difference of one one-thousandths of an inch in jet diameter may change a too-lean mixture to a too-rich one. The standard guide to mixture control has been the tachometer. The practice of leaning-out has been to move the mixture handle slowly toward lean while holding constant altitude, attitude, airspeed and throttle position and watching engine revolutions. At a certain point in the movement of the mixture handle the tachometer will show a slight rise in engine revolutions. Often this rise is only as much on the gage as is covered by the width of the needle. If the needle is oscillating the difficulty of using this as a guide can be readily imagined. A further leaning out results in a decrease in engine-revolutions. No engine manufacturer recommends operation on the lean side of best-power (or maximum r.p.m.). A safer guide to leaning out is cylinder temperature, but if this is used, the temperature-rise interval and not absolute temperature must be taken as the indication upon which one can safely judge the mixture. A temperature-rise of 25 deg. F. is considered the maximum allowable in leaning out. The curve of cylinder temperature vs. specific fuel consumption is characteristically abrupt at the point where this rise occurs.

Automatic mixture control

These methods of guiding mixture control are good only in cruising level flight after all the other variables of flight have steadied down. A satisfactory method of control during the almost equally long-continued operations of climb and descent has not yet appeared in general use, unless we go to the new automatic mixture control which has recently appeared on the market. The automatic pitch control on the controllable-pitch propeller of course makes this method of leaning out according to tachometer indications impossible since the tachometer will always indicate constant values, no matter what the throttle or mixture control positions. The temperature guide is still usable with the automatic propeller, although it needs some refinements in order to make it entirely satisfactory.

Engine roughness is one of the factors in reliability often minimized. With the newer engines this factor becomes of paramount importance. All engines and all combinations of an engine and propeller have one or more rough periods, some more violent than others. Any continued operation at the r.p.m. of a seriously rough period of the engine-propeller unit will penalize reliability very severely. The operating tables have been made on the assumption that all such rough periods would be definitely and absolutely avoided.

Just as detonation on inferior fuel will void all engine guarantees and upset any schedule of reliability, so too continued operation at a rough period will throw out all plans with reference to a specified economy of operation, and make any such tabulation as has been attempted here worthless. Every engine or, more accurately, each engine-gear-train-propeller combination has one or more resonant frequencies at which vibration may become destructive. On the Cyclone F3 engine with 16-11 reduction gear and 11 ft., three-blade controllable-pitch propeller, this resonant vibration occurs at 1,500 r.p.m., and the region from 1,400 to 1,600 should be avoided as rigorously as is operation beyond the take-off manifold pressure limit.

An erratic variable

When reliability is spoken of in so specific a manner, it must not be supposed that an engine failure can be predicted merely because statistically the time has arrived, or the 300,000th mile has been flown! Reliability is dependent upon many factors, aside from those indicated, over which we have no control. Engine failure is an erratic variable. Reliability may be greatly increased by a slight change in materials, in care during manufacture, finish of parts, skill in assembly, inspection on an airline, overhaul at terminals, quality and lead content of fuel. We have not enough data on which to base exact reliability curves until a large number of engines have actually run the total number of hours included in the curves of reliability factor. By the time these data can be collected and compiled the engine may be obsolete. It is believed, however, that the difficulty and uncertainty is not sufficient to warrant abandoning the attempt to outline the tendencies and the quantitative influences of some of the factors involved in reliability. A beginning has been made in the analysis of this problem. It is hoped that the controversy and discussion growing out of this beginning will lead to a rich and valuable development in the field of air transport economics.

Professors Hard C. Willet (left) and Carl Gustaf Rossby (right) of the Massachusetts Institute of Technology are shown receiving the Reed Award for their work on the practical application of air mass analysis methods to American meteorology from Charles Lawrance, retiring president of the Institute

Institute Abstracts

A digest of some of the many papers presented at the third annual meeting of the Institute of the Aeronautical Sciences.

MARKING the completion of the second year of its useful and successful existence, the Institute of the Aeronautical Sciences presented at its annual meeting on Jan. 29 and 30 one of the most comprehensive programs of aeronautical papers ever prepared for a single convening of a technical society. The two-day session, held in the Physics Building of Columbia University, included meetings devoted individually to the fields of Meteorology, Radio, Instruments, Metallurgy, Air Transport, Aerodynamics, and Power Plants and Fuels. The attendance throughout was excellent. The Annual dinner which followed the meetings was marked by the introduction of Donald W. Douglas as president for the coming year and the first presentation of the newly established Sylvanus Albert Reed Award.

ACOUSTICAL TREATMENT OF AIRPLANE CABINS *Stephen J. Zand, Sperry Gyroscope Company*

SOUND PROOFING of an airplane should begin in the earliest stages of its design. For maximum results the following ten principles should be adhered to as closely as possible:

1. All metal constructions are preferable to fabric because metal will give a transmission loss of about 15 to 17 decibels.

2. Fourteen-cylinder engines are preferable to nine-cylinder ones. They give a higher pitch and are smoother.

3. Three bladed propellers should be used, preferably of the controllable pitch types and geared in such a way as to give a tip speed at cruising not over 725 ft. per sec. At speeds above 900 ft. per sec, no acoustical treatment will attenuate propeller noise.

4. Engines should be flexibly mounted to provide discontinuity of surfaces. The mounting should be designed to take loads in any direction but should take principally a shear load.

5. Exhaust collectors should discharge their gases as far away from the cabin as possible.

6. The clearance between propeller and structure should be at least twelve inches. The plane of the propeller should in no case pass through the cabin proper or contain any main bulkheads which, excited by the vibration, would transmit by solid conduction the sound of the propeller into the interior, for there is a marked directional of that sound with its maximum in that plane. In that plane should go a baggage space, buffet, toilet or radio room.

7. Between the buffer compartment and the cabin proper should be a bulkhead with such characteristics that it will not be excited by vibration.

8. The mounting of windows should permit the windows to flex. A special glass is available which is less subject to vibratory excitation than ordinary safety glass. They should be small. Two small ones are acoustically superior to one large one.

9. The floor should not take any

direct load except those of the chairs and should be built in small sections spaced by generous rubber or felt gaskets.

10. The ventilating system should be built on the principle of an acoustic duct provided with acoustical filters.

THE DESIGN OF STIFFENERS *Prof Joseph S Newell, Massachusetts Institute of Technology*

IN an attempt to rationalize the design of channel stiffeners and similar sections studies have been made on the applicability of formulas for predicting loads on flat sheets having different conditions of edge support. The studies showed that the crippling strength of a short channel column, L/ρ about 20, may be predicted approximately by considering the back of the channel to behave as a flat plate having all four edges simply supported, while the legs are taken as two flat plates, each having three simply-supported edges and one free edge.

Summing up these crippling stresses was found to yield good agreement with M.I.T. and McCook field tests. Substituting the average stress for the yield point in the Johnson parabolic formula for columns it was found that good agreement can be obtained with the tests for channels in the short column range. For larger channels the Euler column formula is satisfactory.

Other shapes of stiffeners, lipped channels, zees, etc. have likewise been studied and found to yield close agreement between treatment by the flat plate formulas and test results though these last are unfortunately still fragmentary.

AIRCRAFT ENGINE PERFORMANCE WITH 100 OCTANE FUEL *F. D. Klein, First Lieutenant, Air Corps Materiel Division*

WITH the present use by the Air Corps of fuel with an anti-knock value of 92 Octane an increase of about 33 1/3 per cent in power output per unit weight of engine is obtainable over that derived from engines prior to 1928 which operated with about 50 Octane Number fuel.

Developments of the fuel industry made possible, early in 1934, the production of commercial iso-octane on a large scale at a cost sufficiently low to make the outlook for higher anti-knock fuels appear decidedly promising. By May, the Air Corps had issued an experimental specification and prepared a supply of 2 000 gal. of 100 Octane fuel containing 3.0 ml. of tetraethyl lead per gallon, an amount sufficient for experimental multi-cylinder engine tests to determine the increase of power output possible with such fuel.

The fuel was tested in two engines, a Wasp with a compression ratio of 6 to 1, and impeller gear ratio of 14 to 1, and a cyclone of 6.4 to 1 compression, and 10 to 1 impeller ratios.

In a series of tests at various specific fuel coosumption rates both engines showed a marked increase in power output, the Wasp delivering 620 hp. at 55 lb. per brake hp.hr. against 510 hp. with 92 Octane fuel, an increase of 21.6 per cent, the Cyclone delivering 800 hp. at 60 lb. per hp.hr. against 610, an increase of 31 per cent.

With engines designed specifically to take full advantage of the fuel even larger increments in output might be expected, especially at high altitudes.

COLD TEMPERATURE STARTING OF AIR CORPS ENGINES *H. L. Carpenter, Wright Field*

CONSIDERABLE trouble has been experienced in starting airplane engines of 500 hp. and over at sub-zero temperatures. Most of the ordinary procedures followed by transport operators under such circumstances: oil draining and heating outside the engine; heating the oil in the crankcase by an electrical unit operating on external power; carrying a very light oil in a separate tank to be circulated through the engine just before shutting off; the use of fire pots, hoods, etc.; are not practical for Air Corps purposes.

Heavier starters are obviously indicated but few data were available to form the basis for such a development. Accordingly, the Materiel Division has undertaken a program of tests at Wright Field using a cold chamber and an Air Corps type G1V-1570-F engine.

From these tests it has been determined that:

(a) At temperatures down to 5 deg. F. the engine can be started on the first revolution while being cranked at a minimum speed of 70 r.p.m. At lower temperatures from one to five revolutions are required.

(b) An oil with a comparatively low viscosity is required for (a). If necessary oil coolers should be used to keep down the oil temperature after starting. Grade 98 (SAE 50 heavy) was changed to 77 (SAE 50 light) as 15 deg. F. 77 to 55 (SAE 20 light) at 15 deg. below zero.

(c) The engine should be primed at the intake manifolds directly over the intake valves with a fuel as finely sprayed as possible.

(d) The carburetor must be designed to be adjusted to full rich for starting.

(e) The ignition must be capable of being retarded to prevent back firing. Battery ignition was found superior to magneto ignition for starting.

(f) The starter clutch should never be set over a maximum of 900 ft.-lb. break away torque, lest other parts of the engine be endangered. The torque required to turn the engine should be 600 ft.-lb. lower.

VIBRATION OF PROPELLER AND ENGINE CRANKSHAFT *Dr. Th. Theodorsen, of the N.A.C.A.*

A RECENT increase in the number of propeller failures has focused attention on this problem. Failures can be grouped into shank failures and tip failures. It has been conclusively proved that shank failures are caused by the engine-crankshaft unit and are not directly due to any weakness or faulty design of the propeller itself. The propeller-engine combination forms a mechanical system capable of torsional vibrations. Because of the relative concentration of the inertia involved there is only one critical response frequency. This frequency has been found to be located in the neighborhood of 10-13,000 vibrations per minute for modern one- and two-row radial engines. It may coincide with the frequency of the explosions of the engine. It was in fact found to coincide exactly in a case where shank failure had been experienced.

In regard to tip failures the propeller itself exhibits several modes of critical response, as many as five having been observed during tests in the N.A.C.A. laboratories. Three most common are usually located near 2,000, 6,000 and 10-12,000 cycles per minute.

AIR COMFORT ANALYSIS *Preston R. Bassett, Sperry Gyroscope Company*

AS airplane performance and reliability reach new levels the problem of passenger comfort achieves ever increasing importance.

The boundary between comfort and discomfort may be termed the psychological boundary. As the discomfort increases, a second boundary is reached between discomfort and the unbearable. This may be termed the physiological boundary. Both can be quite accurately laid out for air transport purposes.

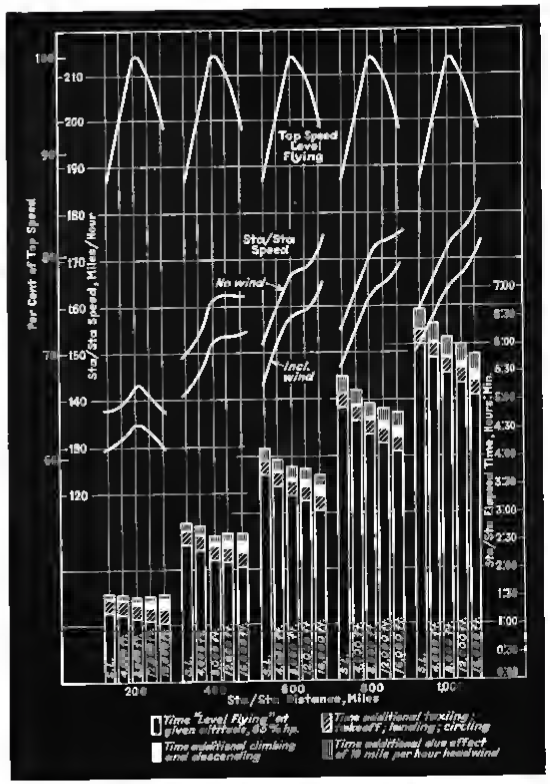
Several physiological boundaries, for example can be set at 120 decibels of noise, 20 deg. of inclination in roll; an acceleration of one g.

Psychological limits, of more direct interest to the designer are 85 decibels of noise; 5 deg. of inclination in roll; an acceleration of one tenth g; seat vibrations of less than .008 in.; 30 cu. ft. of fresh air as a minimum per minute for each passenger; a temperature of 71 deg. plus 2 deg.; an altitude of 10,000 ft.; a rate of descent under 150 ft. per min.; the slightest trace of odor. There is no reason why airplane comfort need be inferior to any

"Speed"

A picture story in transport economics illustrating that a "milk run" cannot be operated on "cream schedules," or what frequent stops can do to an expensively acquired high speed.

By Herbert V. Thaden



THE equipment used in this analysis is typical of a contemporary twin-engined air transport, with altitude — supercharged engines cruising at constant 65 power factor over various station to station distances and at varying altitudes. The engines have a critical altitude around 8 000 ft., with an optimum 65 power factor cruising altitude of 16,000 ft.

The bar charts are developed on a basis of elapsed time between station wheel chocks. These are the times which appear in the "time tables." The time required for taxiing from the station to the end of the runway, checking the functioning of the engines, taking off and orienting the aircraft on the given course as well as the reverse of orienting the aircraft for a landing into the wind, executing the landing and taxiing up to the station, normally consumes from six to eighteen minutes. The actual amount is dependent on various factors such as the adequacy of ground radio advice, type of equipment and training of flight personnel. In the analysis fifteen minutes was assumed.

The "level flying" time was based on the true speed of the aircraft between stations at the stated altitudes. Due allowance was made for the increase in speed in the less dense atmosphere at altitude, keeping, however, a constant 65 power factor. The saving in time at altitude is quite appreciable.

Unfortunately this saving is compensated to a certain extent by the loss in time due to the lower speed of forward velocity during the period of climb to altitude. In the analysis an average maximum rate of climb of 500 ft. per minute was assumed from sea level to the stated altitude. During the descent, some of this climbing loss is recovered, although unfortunately not sufficient to equal it. The rate of descent was assumed at 400 ft. per minute, which is the maximum which appears to be physically comfortable to passengers. The net algebraic sum of the time loss in climb and gain in descent is indicated in the bar chart for the respective altitudes. Above 8,000 ft. it begins to increase rapidly, and as indicated in the station to station distance of 200 miles the altitude climb and descent loss added to the improved level flying time at 16,000 ft., equals the relatively poorer sea level time. Obviously no advantage is gained by climbing to such altitude. In this instance the most efficient time is indicated at 8,000 ft., at which the average schedule speed is 145 m.p.h.

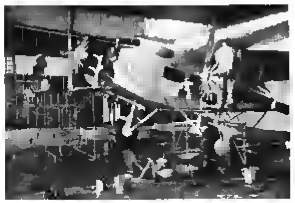
A study of the speed curves in the lower distance brackets indicates that the supercharging of the particular engine used in the analysis was unnecessarily great for use on such distances and better sea level and 8,000 ft. efficiency could have been attained by a lesser degree of supercharging.

This assumes however, that the engines were required on a low level route. In the event that single engine operation over high intermediate terrain were necessitated the high degree of supercharging would still be warranted.

The influence of a 10-m.p.h. head wind is indicated on the time charts and in the speed curves. A properly developed schedule would attain a greater frequency of "on time" arrivals if based on the set of lower curves rather than on the upper curves. The whole problem of wind influence on schedule speed is a matter of detail study, along with the above "climb" and "level flying" speed factors, to determine the most efficient altitude for any specific or average flight condition.

PAA Servicing hangar, Dinner Key

Clipper and Commodore at Havana



Servicing PAA Ford at Cristobal

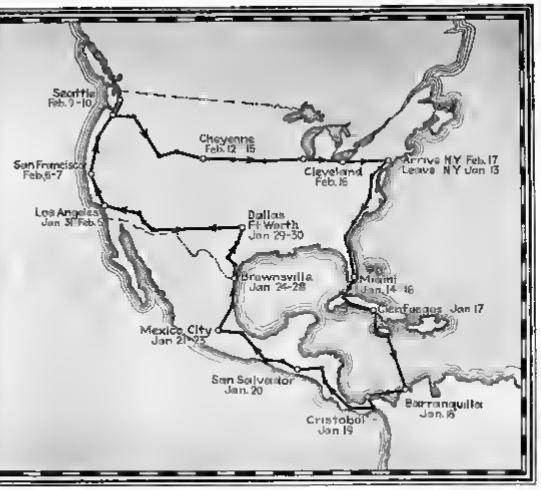
Fueling ship at David R P

Dock and Douglas at Guatemala

Log of an Editorial Junket

By S. Paul Johnston

Associate Editor of AVIATION



AVIATION has never been run on an armchair editorial policy. No industry as widespread as ours can be served adequately with scissors and paste-pot from a New York office. To keep up to date on this aviation business it is necessary to prowl about into all corners of this country, and beyond. One has to get outside the four walls of the office to see things turning over.

The travel map of the editorial staff of AVIATION for the past few years is almost the map of the airways of the United States and the Central Americas. Twice, since 1930, the Editor has travelled extensively in Europe on aviation affairs. Other members of the staff have also covered considerable ground in the course of their editorial duties.

The writer has logged some 30,000-40,000 miles on the airlines during the last few years to study overhaul and maintenance bases, to visit manufacturers, schools, airports, commercial operators, and shops. Between Jan. 13 and Feb. 17, 1935, he made the circuit traced on the accompanying map. He flew in all kinds of equipment, in a Commodore across the Caribbean, in a Condor sleeper over the Southwest, in Fords, in Boeings, in Douglases. He talked with hundreds of people—factory executives, engineers, factory workers, airline executives, pilots, technicians, mechanics, school heads and students, airport personnel, commercial operators. He watched the industry reacting to the changing conditions of 1935. Signs there are aplenty that it is once more emerging from a long hibernation. Certainly, much more optimism prevails at present than was in evidence at this time last year. Things are looking up.

Space does not permit extended treatment of the trip in this issue. Reams of notes, hundreds of photographs, will, however, yield material for a number of articles as time goes on. For the moment, then, only a few notes from the log:

Sun., Jan. 13—Newark to Miami, Fla., via Eastern Air Lines Douglas DC2.

Mon., Jan. 14 Tues., Jan. 15—Miami PAA offices, terminal, servicing hangar at Dinner Key. Also all shops at PAA 36th Street Airport.

Wed., Jan. 16—Took off Dinner Key Terminal a.m. on PAA Commodore to Havana. Across inland to Cienfuegos, Cuba, overnight.

Thurs., Jan. 17—Off Cienfuegos harbor 6 a.m. Kingston 11:30 a.m. Landed Barranquilla 5: Inspected Scadta base. Overnight stop.

Fri., Jan. 18—Took off 5:30 a.m. Arrived Coco Solo, C. Z., 9 a.m. Inspected PAA base at France Field, Naval Air Station Submarine Base. To Gatun Locks and Lake by automobile. Overnight at Colon.

Sat., Jan. 19—Left France Field, 6:30 a.m. on PAA Ford. Across Isthmus to Panama. North through Central America to David, R.P., San Jose, C.R., Managua, Nic., Tegucigalpa, Hond., to San Salvador, S.S. Overnight.

Sun., Jan. 20—Took off San Salvador 6:15 a.m. PAA Douglas to Guatemala City, Guat., Tapachula, Mex. (customs) to Vera Cruz, to Mexico City at 2 p.m.

Mon., Jan. 21—Morning, Conference PAA offices. Afternoon, by car to Guadalupe, Tenayuca, Teotihuacan.

Tues., Jan. 22—Morning, visit to Mexican Government aircraft factory, repair depot, training school. Afternoon, "floating gardens" at Xochimilco.

Wed., Jan. 23—Left Mexico City, PAA Douglas to Brownsville, Tex., via Tampico. Afternoon, PAA shops.

Thurs., Jan. 24—PAA shops and hangars.

Fri., Jan. 25, Sat., Jan. 26—Conference, Maintenance Committee, Aeronautical Chamber of Commerce, Hotel El Jardin. (See page 100.)

Sun., Jan. 27—Brownsville.

Mon., Jan. 28—Morning, PAA shops and hangars. Left 2 p.m. on Braniff Air Lines' Ford for Dallas via San Antonio and Fort Worth. Arrived 8 p.m.

Tues., Jan. 29—Love Field, Dallas, Tex. Braniff Air Lines maintenance shops. American Airlines and Delta Airlines traffic offices. Dallas Aviation School (Long and Harmon), Van Cleave Airplane Company, E. F. Booth (Waco), Lou Foote Flying Service.

Wed., Jan. 30—Love Field to Meacham Field, Fort Worth, via Braniff Airlines. American Airlines maintenance and overhaul shops. Bowen Air Lines service and overhaul shops. Left 10 p.m. for Los Angeles via American Airlines Condor sleeper.

Thur., Jan. 31—Arrived Grand Central Airport, Glendale 6:30 a.m. Grand Central Airport offices. American Airlines and TWA service hangars, Air Associates, Airplane Development Corporation, Kinner Airplane & Motor Corporation.

Fri., Feb. 1—Douglas Aircraft Company, Northrop Airplane Corporation, Mines Field, Inglewood.

Sat., Feb. 2—Menasco Manufacturing Company, Los Angeles.

Sun., Feb. 3—Santa Monica, Cal.

Mon., Feb. 4—Grand Central Airport, Glendale. Curtiss-Wright Technical Institute shops and classrooms. Aircraft Industries, Inc. Airplane Development Corporation. Lockheed Aircraft Corporation, Burbank.

Tues., Feb. 5—Douglas Aircraft Company, Santa Monica. United Air Terminal, Burbank. Western Air Express servicing and maintenance shops. Pacific Airmotive shops.

Wed., Feb. 6—Grand Central, Glendale. Timm Aircraft Company. Took off 10 a.m. from United Air Terminal via United Air Lines for San Francisco. Arrived Oakland 12:30 p.m. Afternoon, Boeing School.

Thurs., Feb. 7—Inspection of Bay area from Waco C including stops at Hamilton Field, Palo Alto, San Francisco Airport, McGraw-Hill offices.

Fri., Feb. 8—To Seattle via Medford and Portland on United Air Lines. Evening, dinner meeting of local N.A.A. chapter and Seattle Aviation Industries.

Sat., Feb. 9—Boeing Aircraft Company and Boeing Field (U.A.L. Servicing Hangar, Washington Aircraft & Transport Corporation, Leonard Petersen, Inc., Rasmussen Meadows Inc., Northwest Services Inc.)

Sun., Feb. 10—Seattle. Leave 4 p.m. for Portland via U.A.L. Overnight Portland.

Mon., Feb. 11—Left 7:40 a.m. via U.A.L. Arrive Pendleton 8:30. Held 24 hours—bad weather.

Tues., Feb. 12—Left Pendleton 6:10 a.m. to Cheyenne, Wyo., via U.A.L. via Boise, Salt Lake City.

Wed., Feb. 13, Thurs., Feb. 14; Fri., Feb. 15—United Air Lines Maintenance and Overhaul Shops, Cheyenne, Wyo. Wyoming Air Services service hangar. Left Cheyenne 7 p.m., Feb. 16.

Sat., Feb. 16—Arrived Chicago 3:45 a.m. Off for Cleveland 6:45 a.m. arriving 11:15. Afternoon at Cleveland Airport U.A.L. Service Hangar, Pennsylvania A.L.&P. Maintenance and Overhaul Shops. Airmotive Sales and Service, Skyways, Inc. Sundorff Aeronautical Corporation Aircraft Service Company.

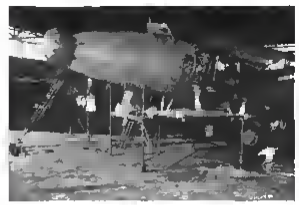
Sun., Feb. 17—Cleveland to Newark.

Sullivan inspect Douglas at Vera Cruz

V wash and polish at Brownsville

American Airlines' Fort Worth base

Hangar line Grand Central Glendale



United's service hangar, Cheyenne

EDITORIALS

AVIATION

What Next in Washington?

IF ANYONE was so optimistic as to suppose that the report of the Federal Aviation Commission would be accepted by acclamation as providing a way out of aviation's fogs of controversy and flashing the all-clear signal for a go-ahead, he knows better by now. Like all its twenty predecessors, the Commission has served first of all to provide fresh fuel for the fires of debate and to furnish a fresh springboard wherefrom a flock of habitual headline-hunters can bound into their favored spots in bold-face 36-point type.

Public opinion, so far as it has spoken, has been sympathetic to the Commission's proposals. A careful survey of editorial expressions from the daily papers show them more than 85 per cent favorable, many of them enthusiastically so. Some of them show the results of careful and detailed study of the report. Many more, however, are written out of a simple conviction that it is time for aviation to have a New Deal of major dimensions, that the nation's transportation system and the national defense are too important to be made the helpless instruments of anybody's politics, and in general that American aeronautical progress ought to be freed from the danger of suddenly-imposed major operations at the hands of amateur witch doctors fully equipped with a complete set of fads and phobias, but otherwise blissfully ignorant of the subject with which they are dealing. The past year has provided enough of that to last a lifetime.

But public opinion, and the editorial writers that focus it, have had plenty of other things to think about. Aviation has had only a minor share of their attention, and in the meantime Washington has been headquarters for the good people who have thought it better for their private purposes to ridicule the Commission's procedure and to malign the characters of its members than to meet its recommendations on their merits. As a result of their activities, there are those who now assume that the Federal Aviation Commission's survey and recommendations for remedy are destined for a swift non-stop flight from the pens of their authors to the dust-gathering archives, without a pause for serious consideration along the way.

It may be so. We scarcely think it, for obviously the disdainful attitude is far from general among the men whose views will ultimately be controlling, but it may be. Whether or not it is—whether the report is to become the basis from which the United States will at long last build an air policy, or whether it is to be consigned to the fast-filling storehouse of Forgotten Documents, will depend very largely upon the American people. If we as a nation want an orderly development of aviation in accordance with a fixed program, with politics left out and with experts in control where expert talents are needed, we have the chance to say so. If we want to regard aviation exclusively as a source of thrills, with the thrill of imputed scandal and that of revolutionary upheaval filling the gaps between the thrills of spectacular long-distance flights, we have only to remain indifferent to attempts to legislate a unified air policy and we shall probably get our wish.

The readers of AVIATION, whatever the nature of their own interest in aeronautics and whatever their own views upon the course that policy should take, are interested in this matter. Whichever side they may be on, they have both the opportunity and the obligation of speaking their minds as loudly and as clearly as possible. It is their civic duty, apart from any selfish interest, to carry on even beyond that point and to make their special knowledge of the subject and their convictions of its importance available to their friends and neighbors, that they too may express themselves. Every one of them ought to do so.

To Set the Record Straight

WHILE the Federal Aviation Commission's report and its bearing on future governmental action remain live subjects and important ones, a few apparent misapprehensions might well be cleared up. It is very evident, as we foresaw would be the case as soon as we became aware of the report's bulk, that many of the critics in matters of detail did not take the trouble to read before criticising. Had they spent a few hours doing that, they would have discovered that many of the things they thought they were criticising weren't there at all, while in other cases their criticisms had been anticipated, recited in some detail in the report itself, and answered.

Much more serious than any such differences of opinion on individual recommendations, however, is a widespread and carefully fostered misconstruction of the President's message of transmittal. His failure to concur in the proposal for a newly-created air commerce commission has been heralded as carrying with it a general rejection of the FAC recommendations, upon the theory that without the permanent commission the whole structure would fall to the ground. That is, of course, absurd. The slightest study reveals its absurdity.

The one recommendation that might be considered as relating to an executive function that should remain in an executive department rather than be transferred to commission control, that concerning licensing and inspection, could be detached from the body of the report without affecting a single one of the other 100 recommendations in the slightest degree. With or without such detachment, every function proposed for the air commerce commission advised in the report could equally well be assigned at once to an aviation division of a commission charged with general supervision over all transportation matters. Although we think there are some advantages in a completely separate handling of aviation during the formative period of a new system of regulation, we would see no very serious objection to such an immediate assignment to a suitable division of a general commission evolved out of the I.C.C. The recommendations in the Commission's report could remain substantially intact under such a regime.

Always provided, however, that the permanent set-up is developed with reasonable promptness and that when developed it includes a real and not a sham provision for aviation. No one seems to know whether it will take three weeks or three years to thresh out the difficulties of an I.C.C. reorganization and to get action. Some of Washington's best-informed commentators advise that the chances for legislation at the present session of Congress are negligible. In the meantime, air transport lives on from day to day, awaiting fresh news of its fate. The present plan, under which harassed and hard-driven members of the I.C.C. accept the responsibility for aviation without having time to inform themselves properly upon it, and then delegate most of their functions to members of their professional staff, is intolerable. The proposed Eastman plan, which would arbitrarily establish aviation as the step-sister of the motorbus and truck, would be practically as bad. If the regulation of aviation is to be co-ordinated with that of other forms of transport it must have a place to itself in the regulative system. Anything else will be ruinous.

This is not a personal issue. The difficulty is not with the men. We have no doubt that almost any three or five members of the present Interstate Commerce Commission, if aviation were given to them as their sole responsibility and after they had had a chance to get acquainted with their new job, would handle it admirably. It is not essential that a commission consist of aviation experts. It *is* essential that it contain honest and able and hard-working men who are able to give their time to the problems of aviation, certainly no less complex and no less varied than those of any other form of transport, and are not in the position of having to make the railroads or the highways their primary interest and aviation a secondary or tertiary one. Upon the necessity for commission control over those affairs of aviation which are primarily judicial in their nature or which involve the allocation of government aid, and upon the importance of giving the commissioners enough freedom from other duties so that they will be able to do their aviation job properly, we are inflexibly clear in our own mind. We are for that for just one reason. It is the only thing that will work.

"Bad Casualty"

OFFICIALLY laconic and officially correct, the phrase in which Commander Wiley reported the impending destruction of the *Macon* ran no risk of overstatement. It was a bad casualty, not only for the *Macon* but for rigid airships. In that skilled handling of the situation and cool and courageous behavior saved all but two of the crew, this was the least serious of airship disasters. In that it appears to have been chargeable to no avoidable error of judgment, but to have overtaken the ship while it was following a normal course under normal conditions and in the hands of the most expert personnel it was the worst.

One thing is still certain. The rigid airship *can* be a safe and useful craft. It is still experimental. Very few ships have been built. Some of them have achieved notable success. The problems of their design are enormously complex. How long it will take to solve them all, and to foresee and eliminate all the causes of accident, no one can tell. But it can be done. All the harsh things that are now being said about the airship have been said in the past, and with as much apparent reason, about the airplane. They can, by persistent effort, be made to sound as ridiculous in the one case as they now do in the other. To determine whether or not the effort is worth while, we have to balance the possible future of the airship against a probable cost. To strike such a balance, in the light of the *Macon* disaster, requires more information than is yet in hand. For the next few weeks, all effort should be concentrated on securing it. Categorical conclusions reached in the meantime proceed rather from the emotions than from the intellect. We propose to withhold judgment until the evidence is in. We recommend the same course to others.

Note: The publishers of AVIATION *have selected and reproduced a large number of typical excerpts from newspaper editorial comment on the Federal Aviation Commission's report—both favorable comment and hostile, so far as any of the latter could be discovered. A limited number of copies are available, and so long as they hold out they will be sent on request to subscribers applying for them. Those desiring copies of the complete report can secure it for 20 cents from the Superintendent of Documents, Government Printing Office, Washington.*

NEWS of the MONTH

★ *Services* . . . Army and Navy present to Congress construction programs for air defenses and new planes . . . Naval Court of Inquiry investigates loss of the Macon.

★ *Legislative* . . . Table of aviation bills now before Congress.

★ *Air Mail and Transport* . . . Aero Chamber Maintenance Committee holds mid-winter meeting . . . Airlines buy new equipment, improve services with more, faster trips . . . Air express shows big gain for 1934 . . . D. of C. Court of Appeals gives transport companies right to sue government for broken contracts in Court of Claims . . . Farley files objections to ICC report on fair compensation for mail carriers.

★ *Foreign* . . . Codos and Rossi forced down in attempt to set new distance record.

★ *Industrial* . . . D. of C. awards contract to Waterman for tailless plane . . . Services award contracts for planes, engines, and parts.

Services ask building funds

ARMY and Navy construction programs calling for expansion of air base defenses and increased plane power for the Air Corps are now before Congress, the projected expenditures representing a record peace-time outlay for national defense. To the House Military Affairs Committee General Douglas MacArthur, chief of staff, has submitted proposals for the construction of an $11,000,000 air base in Hawaii and the purchase of 800 new airplanes—total cost, $90,000,000. The new Hawaiian air base would be situated at the western edge of Honolulu occupying 2,600 acres between the city and the Pearl Harbor Naval Base. To finance it, the War Department proposes to use its share of the $300,000,000 Public Works fund for regular government building operations recommended in the President's budget message and now before the House Appropriations Committee. Chairman John J. McSwain of the House committee pointed out that construction of such a base had been authorized by Congress several years ago but funds for the purpose had never been appropriated.

In discussing the proposed purchase of new planes, General MacArthur said that the Army needed immediately 175 pursuit, 200 bombardment, 130 attack, 140 observation, 100 training and 65 cargo ships. These would bring the Army's quota up to the 2,320 modern aircraft recommended by the Baker Board, and could be efficiently procured in a period of from two to three years. He said that the appropriation laid down in the 1936 budget would pay for only 488 planes which must be used for replacements—thus allowing little progress on the air expansion program.

General MacArthur's complete program for the modernization of all branches of the Army involves an expenditure of $400,000,000 (a $90,000,000 increase over the budgetary allowance of the War Department for the fiscal year 1936) and is about double the average annual appropriation for military purposes.

Speaking for the War Department before the House committee Feb. 11, General Kilbourne declared that the $190,000,000 bill introduced by Representative Wilcox calling for ten frontier air bases was unacceptable. He offered a substitute measure giving the Secretary of War authority within limits to establish air bases where he saw fit. Without provision for specific appropriations, which would be left to the committee, the War Department plan proposes that the new bases be limited to six, one in Alaska, another in the Canal Zone, and the remainder within the United States. These six bases, General Kilbourne said, would most economically give the GHQ Air Force the peace-time training it needs.

The House of Representatives approved the War Department Supply Bill on Feb. 22, the total of $378,734,448 being $707,165 greater than the budget estimate. To the Army Air Corps as a whole, the committee allotted $45,600,444, an increase of $17,986,947 over the total for the current fiscal year. For new airplanes for the Air Corps, including an increase for more flying hours, the bill provides $20,350,000, for radio equipment for airplanes, air stations, combat cars and tanks, $2,800,000, for armament for aircraft, $1,700,000. The National Guard gets $870,994 for new airplanes, spares and maintenance, and the Organized Reserves, $549,280 for new planes, and operation and maintenance of planes. The bill made no provision for the Hawaiian air base or Pacific Coast defenses, but these items are to be brought under the Public Works program later.

The Navy's $33,000,000 program of shore construction has been introduced to Congress as a bill by representative Darden of Virginia, head of the House Subcommittee on Public Works. A large portion of the money would be spent at the Naval Air Station at San Diego. Aviation facilities would be improved and expanded also at Pearl Harbor, Honolulu, Coco Solo, C. Z.; Norfolk, Va.; Pensacola, Fla. Radio and direction finder stations would be established at Sandy Hook, N. J.; Washington, D. C.; in Hawaii, the Canal Zone and Panama. It is proposed that $20,000,000 of the total expenditure of $33,000,000 be allocated by the President from the $300,000,000 Public Works fund.

Maintenance at Brownsville

The hospitality of the Pan American personnel and the City of Brownsville will be long remembered by the Aeronautical Chamber of Commerce Maintenance Committee and certain manufacturers' representatives who met in a two-day session at the El Jardin Hotel, Jan. 25-26. By the time the meeting opened the agenda included some 50 separate items for discussion, covering practically all phases of the operation and maintenance of modern transport aircraft. Members of the conference not only pooled their experience on troublesome items, but also looked ahead into the future, anticipating, for the benefit of designers and manufacturers, troubles which may be expected with larger and faster equipment. For the first time, representatives of the Department of Commerce attended the session, a hopeful sign for cooperation with the government regulatory departments and those with whom the responsibility for the upkeep of equipment rests. Although, in accordance with the usual custom, the actual sessions were open only to members of the committee, every manufacturer's representative who was present at Brownsville was given an opportunity to appear before the committee to answer questions proposed by the members and also to speak generally on new developments of his company of interest to the airline operators.

Walter A. Hamilton of TWA steered the discussion very efficiently through the two-day sessions. Great credit also goes to Fowler W. Barker, assistant secretary of the Aeronautical Chamber of Commerce, for the organization of the program and the smooth handling of all details connected with the conduct of the meeting. Members of the committee present were: Paul Braniff, Braniff A.L.; William B. Click, A.A.; W. P. Hoar, U.A.L.; H. D. Ingalls, A.A.; J. B. LaMont, N.W.A.; W. S. McDuffee, Bowen A.L.; William Miles, Delta A.L.; Paul Moore, A.A.; Sterling E. Perry, Braniff A.L.; C. Regan Stinkel, Bowen A.L.; R. D. Sundell, Pan American. H. O. West, U.A.L. AVIATION was represented by the Associate Editor.

Department of Commerce representatives attending were Oscar Wallace and Philip Salzman of the Airline Inspection Service based in the Southwest.

Manufacturers' representatives who attended were: K. J. Boedecker, Wright Aeronautical Corp.; Ray Brown, General Tire & Rubber Co.; Homer Bredouw, Bredouw-Hilliard Co.; John L. Bunce, Pratt & Whitney; C. C. Cole, Douglas Aircraft Co.; Thomas B. Colby, Berry Bros.; Robert Dake, Kendall Oil; W. H. Dubois, Bendix Corp.; Hal Henning, Texas Co.; L. O. Gunther, Goodyear; R. H. Isaacs, Eclipse Aviation; R. W. Leedom, B. G. Corp.; James Pedlar, Goodrich; M. C. Pope, Electric Storage Battery; Frederick C. Pyne, Aluminum Co. of America; Carl F. Schory, Hamilton-Standard; Carl B. Squier, Lockheed Co.; L. W. Trees, Scintilla Co.

In winding up the sessions, recognition was given Walter Hamilton's outstanding work on behalf of the Maintenance Committee by his re-election to the chairmanship for the succeeding year. At the invitation of United Air Lines, Cheyenne, Wyo., was designated as the next meeting-place the latter part of July, 1935.

Calendar

Mar. 5—Aeronautical Section, 6th Annual Greater New York Safety Conference, New York City

March—General meeting, ISTUS, Berlin, Germany

May 18—Deutsch de la Meurthe Cup Race, Paris, France

June 29-July 14—4th annual meeting, Soaring Society of America, Elmira, New York

Braniff buys Electras

Seven new Electras scheduled for early delivery have been ordered from Lockheed Aircraft Company by Braniff Airways. With the new equipment the airline will inaugurate night service on its route from Chicago to Brownsville, Texas, via Dallas, with a branch line to Amarillo, now flown by Lockheed Vegas, Stinsons and Fords. In preparation for the night-flying the company has started construction of radio communication stations along the route.

A fifth airline began operations with Boeing transports last month when new schedules were inaugurated by Wyoming Air Service between Billings, Mont., and Pueblo, Col. The trip from Denver to Cheyenne now requires only 40 minutes and connections with United Air Lines at Cheyenne insure speedy service to both the Atlantic and Pacific seaboards. Two round-trips are made daily. With the new equipment the following schedules are possible from Denver: To Chicago 8 1/3 hours; to Cleveland 11 hours; to New York 14 hours; to Washington 17 hours; to San Francisco 9¼ hours; to Los Angeles 8 2/3 hours; to Seattle 11 1/3 hours.

Another coast-to-coast schedule to Los Angeles over the mid-continent route via Salt Lake City was added Feb. 15 when Western Air Express put on a second daily round-trip over the Salt Lake-Los Angeles route. Acquisition of a fourth Boeing 247 from United Air Lines preceded the inauguration of the new schedule. Stewardess service is now available on WAE.

Eastern Air Lines inaugurated Jan. 25 one round-trip Douglas schedule daily between Newark and New Orleans, stopping only at Washington and Atlanta and covering the 1,303 miles in 8 hours 15 minutes. The service takes 5¼ hours to Atlanta. Both northbound and southbound trips are flown at night. By day there is a round-trip Condor schedule which with eleven stops en route takes 13 hours for the trip. Eastern Air has also put on new limited schedules non-stop between New York and Washington, flying time being 1 hour 20 minutes in each direction. The southbound plane leaves at 11 a.m., the northbound at 4 p.m. Five other round-trip daily flights now requiring 1 hour 50 minutes will be replaced by the new high speed schedules if they prove popular.

A new daylight westbound transcontinental service of 17 hours 50 minutes became effective on Transcontinental & Western Air Feb. 20. Leaving Newark at 9 a.m. the plane flies via Pittsburgh, Chicago, Kansas City, Albuquerque and arrives at Los Angeles at 2:50 a.m. (Pacific time). To enable passengers to see the Grand Canyon from the air, another new service has been inaugurated, leaving Newark at midnight and arriving in Los Angeles at 8:50 p.m. (Pacific time). Between Winslow and Los Angeles this schedule will be flown over the south rim of the canyon. To maintain its three daily transcontinental schedules and three daily round trips to Chicago, Transcontinental & Western Air has acquired eight additional Douglases, bringing its total to 30.

United Air Lines established a rec-

MAINTENANCE MEN MEET

with representatives of equipment manufacturers at the Pan American Western Division Headquarters at Brownsville, Texas, on January 25-26

ord in January when it flew its 500,000th revenue passenger. Illustrating the growth of traffic within the last few years, United reported that only about 125,000 passengers were carried over its system in the first five years, fewer passengers than the company carried last year alone when it transported 147,000 passengers.

According to the 1934 annual report Union Air Terminal at Los Angeles may be ranked among the busiest of the Pacific Coast airports. Included in figures for the year published by Fred Denslow, president and general manager, 38,976 transport revenue passengers were checked in or out during the year, registering a net gain of 36 per cent over 1933 figures. The total number of all person flying in or out during the year, including private fliers, students, transport pilots and crew members and Army mail pilots was estimated at 128,876. The number of daily scheduled transport arrivals and departures was 26 as of Dec. 31.

The number of air express shipments handled through the Air Express Division of the Railway Express Agency in 1934 increased 102 per cent over 1933 while tonnage registered a gain of 115 per cent. Revenue, despite rate reductions in August was up 90 per cent. The average charge for an air express package last year was $2.98, although most of the shipments were ¾ lb. units for which the rate is now $.85, or 1 lb. with a rate of $1. Average haul for the year was 1,100 miles, about the same as in 1933. The system comprises the routes of 14 airline operators, serves 120 airport cities.

Air express service between the United States and Venezuelan cities has been inaugurated by Pan American Airways in cooperation with the Railway Express Agency. Arrangements with the Venezuelan government to eliminate certain customs difficulties have been completed, insuring a service three times faster than any heretofore available. Present schedules offer service three times weekly through Miami and frequent flights from Brownsville and Los Angeles.

Newest member of General Air Express is Bowen Air Lines operating from Fort Worth to Houston, Austin, San Antonio and Brownsville. Connections will be made at Fort Worth with American Airlines, linking Texan cities with the rest of the United States, and at Brownsville with Pan American's planes to Central and South America. General Air Express now includes eight airlines.

Farley objects

Postmaster General Farley has filed a brief with the Interstate Commerce Commission listing numerous exceptions to its report on air mail compensation (AVIATION, February, page 63) and asking that hearings on air mail contracts be reopened. The brief reiterated the Postmaster General's opinion that the I.C.C. has no authority to increase the rate of compensation for mail carriage above that which a contractor bid, either during the period of the temporary contracts, the period of the extended contracts, or upon the indefinite continuance of the extended contracts, (AVIATION, Sept., 1934, page 295). The Postmaster General said that recent reorganizations of transport companies leading to transfer of mail contracts have considerably altered operating expenses, consequently, most of the contractors had been unable to hand in reports covering six months of operating costs under new conditions, and that equitable rates of pay could not, therefore, be established on the basis of facts developed during hearings held in October.

Aviation in

The Progress of Legislation

Number of Bill	Introduced By	Purpose and Present Status
AIR TRANSPORT		
S. 932 HR. 3455 HR. 4135 HR. 5218 HR. 9210	O'Mahoney (Wyo.) Buck (Cal.) Dockweiler (Cal.) Bruener (N. Y.) Rich (Cal.)	Designed to amend in various fashions the provisions of the present air mail act as primary and secondary routes and to permit continued operation of United and American systems as now constituted. S. 932 passed Senate and House and has become law.
HR. 9924 HR. 9192	Mead (N. Y.) Mead (N. Y.)	To allow the I.C.C. to re-adjust air mail rates either upward or downward to a maximum of 35 cents a mile for 300 lb. loads and to let the Postmaster General extend existing routes and create new ones.
HR. 4915	Martin (Col.)	To authorize extension of the air mail system from the present 20,000 route miles to 30,000 and to allow 45,000,000 miles of flying annually with mail.
S. 1382 HR. 9174	McCarran (Nev.) Lea (Cal.)	Both these lengthy bills (which are quite different in language) would set up an air commerce commission and essentially carry into effect the recommendations of the Federal Aviation Commission on air transport.
HR. 2840	McLeod (Mich.)	To create a Department of Aeronautics, to handle civil aviation only.
HR. 4880	Sirovich (N. Y.)	To establish a government monopoly over air transport, its director general to take over the present functions of the Bureau of Air Commerce, the National Advisory Committee for Aeronautics, and all the airlines in the United States.
S. 1844 HR. 9159	Hayden (Ariz.) Dimond (Alaska)	To authorize the Postmaster General to contract for additional air mail service in Alaska.
HR. 3084	Koeppel (Cal.)	To reduce the air mail rate on the communications of members of Congress to 3 cents.
HR. 2744	Condon (R. I.)	To lend $12,000,000 of Reconstruction Finance Corporation money to the Rescues Aeronautical Engineering Corporation for the construction of new airships and the start of a trans-Atlantic service.
PROCUREMENT OF AIRCRAFT		
HR. 4811 HR. 5097	McSwain (S. C.) McSwain (S. C.)	To provide for the payment of royalties on aircraft built by anyone other than the original designer and to establish the control of the Comptroller General over the details of procurement.
HR. 4465	McSwain (S. C.)	To repeal war-time legislation for exchanging old army equipment for new.
HR. 5384	McSwain (S. C.)	To permit direct suit on account of infringement of a patent, against a manufacturer for the government.
AIRPORTS		
S. 797 HR. 1408 HR. 3437 HR. 3808	Gibson (Vt.) McSwain (S. C.) McSwain (S. C.) Smith (Va.)	To establish a Washington airport in various localities as variously designated in the several bills.
HR. 2804 HR. 2805	Peyser (N. Y.) Peyser (N. Y.)	To make Governor's Island (New York) a public transport terminal and to authorize the expenditure of $2,500,000 for increasing its present area.

Air mail suits

In a decision handed down Feb. 4, the U. S. Court of Appeals of the District of Columbia held that cancellation of the air mail contracts in February 1934, amounted to a breach of contract and gave the right to five complaining companies to sue the government in the U. S. Court of Claims. The court, however, upheld the District of Columbia Supreme Court in dismissing the companies' injunction suits against Postmaster General Farley, saying that the complainants had a "remedy at law afforded by a suit in the U. S. Court of Claims." The five transport companies seeking the Farley injunction were Boeing Air Transport Co., Varney Air Lines, National Air Transport Company, Pacific Air Transport Company (AVIATION, May, 1934, page 155) and Pennsylvania Air Lines, (AVIATION, July, 1934, page 221). All of them were suing Farley as an individual rather than in his official capacity as Postmaster General. The lower courts and the Appellate Court held that whether the suits were directed against Farley as an individual or as a cabinet officer was of no consequence since the government would be compelled to pay any sums recovered.

The Appellate Court's decision that the companies could sue the government in the Court of Claims had already been authorized by the Air Mail Act of June 12, 1934, which gave the right to any company whose contract was cancelled to bring suit against the United States for damages in the Court of Claims provided that such suit be brought within one year after the passage of the Act.

New taxes

A bill introduced in the New York State Senate Jan. 30, provided for the establishment of a permanent state aviation commission to regulate civil flying, and imposed new taxes on the industry to pay for the salaries of the commissioners. Among other things the bill proposed that airplanes be taxed annually from $25 to $200 according to weight, and that each pilot be taxed from $1 to $5 according to grade. Airports were to pay $100, and each school, dealer and manufacturer from $25 to $100. When hearings on the bill were held before the Senate Judiciary Committee Feb. 20, pilots throughout the state flew to Albany to register protest. As a result, this bill was shelved and a substitute (Number 669) was passed and signed by Governor Lehman March 2. The latter bill simply provided for the continuation of the temporary state commission (established in 1930) and appropriated $15,000 for the commission's expenses.

Congress

Introduced and Pending

Number of Bill	Introduced By	Purpose and Present Status
NATIONAL DEFENSE		
HR. 4130	Wilcox (Fla.)	To establish ten new Army air stations in the United States and its possessions, in locations as defined in the bill, each station to provide for 1,000 airplanes and the total cost to be $180,000,000.
HR. 4131	Wilcox (Fla.)	To authorize $11,314,000 worth of new construction at Chapman Field, Miami.
HR. 4139	White (Ida.)	To establish a depot for the Army Air Corps at Lewiston, Idaho.
HR. 5065	Hill (Wash.)	To establish a depot for the Army Air Corps at Spokane, Wash.
HR. 4391	McSwain (S. C.)	To set up a separate promotion list and a fixed rate of promotion for the Air Corps and to allow retirement of officers at 64 years of age or after twenty years of active flying.
HR. 9293	Thomason (Tex.)	To increase the size of the Army, and especially to commission additional regular Air Corps officers to a total number of 3,014.
HR. 2818	Kvale (Minn.)	To restrict flight orders and flight pay for non-flying officers other than flight surgeons to 1 per cent of the total commissioned strength of the Services.
HR. 9004	Dockweiler (Cal.)	To establish an Air Corps base in Alaska at a cost of $4,000,000.
HR. 5367	Griffin (Ohio)	To transfer naval constructors engaged in aeronautical engineering duty from the construction corps to the line of the Navy.
HR. 6370	McSwain (S. C.)	To create a joint board reporting directly to the president to coordinate the Army and Navy.
HR. 5283	McSwain (S. C.)	To stabilize prices and control industry in war.
HR. 6677 S. 1801	Delaney (N. Y.) Trammell (Fla.)	To enroll naval reserves for four years of active Fleet service, locating Pensacola training base with rank of aviation cadet. Favorably reported by the House Committee on Naval Affairs.
HR. 6804 S. 1974	Vinson (Ga.) Trammell (Fla.)	To transfer naval constructors engaged in aeronautical duty to the line of the Navy.
MISCELLANEOUS		
HR. 2844	McLeod (Mich.)	To make the interstate transportation of a stolen aircraft a federal crime.
S.J. Res. 14	Pittman (Nev.)	To provide for American participation in the work of the International Technical Committee of Aerial Legal Experts and to pay the costs.
HR. 6004	Kenney (N. J.)	To establish a bureau of aviation in the office of the Commissioner of Education and for the investigation of the aviation industry and the dissemination of information for its promotion.
S. 92		To prohibit photography or sketching of military and naval installations or equipment and especially any use of aircraft for the purpose of photographing or sketching such installations. Passed the Senate January 30.

The tentative starting date of the international air race for the western hemisphere which is being promoted by Elliott Roosevelt, General Hugh S. Johnson and Fred Roper has been postponed until spring of 1936. The 18,500-mile course as contemplated in the preliminary outline will go from Washington to the Canal Zone via Miami, thence down the west coast of South America, returning by way of the east coast, crossing at some point on the Isthmus of Panama, and returning to Washington by way of Mexico City, the Pacific Coast, Chicago and New York. An effort is being made to obtain prize money amounting to at least $100,000 and lap prizes will also be given to the contestant completing a particular stretch between control points in the shortest elapsed time regardless of the position in the race he then holds. Rules for the race have not yet been published but it is expected that specifications will be as simple as possible and that the contest will be essentially free-for-all. Every nation in which air-

Aircraft pool proposed

To facilitate the travel of Federal employees on government business, Eugene L. Vidal, director of Air Commerce, has suggested a central aircraft operating pool for the government from which the various departments could draw planes and pilots for official travel.

The law now prevents departments from using any of their funds for the purchase of aircraft unless specially authorized by Congress. The proposed pool would eliminate this difficulty, since each member would allocate from its travel allowance funds proportionate to its use of the pool's equipment and personnel. Of 31 Federal agencies surveyed by a Bureau representative, 16 said that availability of such a pool would be helpful to their officials and that they would make use of it. Two general types of aircraft were favored, first, a reliable economical, easily controlled plane, second, an autogiro which could be landed in places not having airports.

Intercontinental derby

craft is built will be urged to participate and special efforts will be made to obtain entries from the countries over which the route passes

N.A.A. ranks racers

Following a practice which has long been standard in tennis the National Aeronautic Association Contest Committee has established an annual ranking of racing pilots, based on their overall performance during the year in closed course competition at meets sanctioned by the association Ranking is based on a system which allocates a value in "points" to each place in various competitions, considering the importance of the event, displacement limitations, and mileage covered Individual ranking will then depend on the annual total of points amassed by the competitor Lee Miles has been given first rank for the past year with 970 points Roscoe Turner, winner of the Thompson Trophy, giving him a total of 700 points, was awarded second place Roy Minor was placed third with 590 points Harold Neumann and Ralph Bushey placed fourth and fifth respectively

Roger Don Rae was named as ranking parachute jumper, having a total of three firsts, one tie for first, and two thirds. The late Jerry Wessling was given second place Shirley Rauner was placed third

The Contest Committee has announced that the same engine displacement classifications (200, 375, 550, 1,000 cu in. and unlimited) which were settled upon as official for 1934 and 1935 will be retained for free-for-all air races during 1936 The N A A subcommittee charged with drafting specific recommendations for the displacement classes has proposed a reduction to only four groups for 1937 This proposal on which final action will not be taken before December, 1935, calls for a 250 cu in., a 550 cu in., a 1 250 cu in and an unlimited displacement group The subcommittee, headed by Dr H C. Dickinson of the Bureau of Standards, argued that with a smaller number of displacement brackets greater prize money can be offered in each bracket and a greater stimulus to development will result

New distance attempt

Paul Codos and Maurice Rossi left Istres near Marseilles, France, Feb 16 in their Bleriot monoplane, Joseph Le Brix, seeking to break their own world's non-stop distance record by flying to Buenos Aires, 6 835 miles away Flying across Spain, down the coast of Africa, past the Cape Verde Islands, they were half-way across the South Atlantic, having been in the air 25½ hours, when a faulty feed line forced them to turn back to Porto Praia They landed there 5½ hours later after a continuous struggle to keep oil feeding into their overheated engine In August, 1933 the two Frenchmen set a distance mark of 5 635 miles, flying from New York to Ryak, Syria Last June they became the only pilots to cross the North Atlantic in both directions when they flew from Paris to New York

NEWEST ARMY AIR BASE

Hamilton Field near San Rafael, Calif., now houses the Army's Seventh Bombardment Group commanded by Major Clarence L. Tinker Built at a cost of more than $[illegible], including $[illegible] of PWA money, the field has a landing area [illegible] acres in extent of which [illegible] acres are macadam-paved Its eight hangars are arranged in convenient double formation The barracks for enlisted men and officers' homes embody latest developments in modern housing

Autogiro tests

The London Morning Post reports that a series of experiments with the autogiro by Reginald A C Brie, British pilot, in cooperation with the Italian Navy culminated Jan 5 when Mr Brie took off from and landed on an ordinary cruiser steaming at 24 knots off the coast of La Spezia The autogiro was a standard Cierva C 30 direct control type The only modification on the cruiser was the provision near the stern of a temporary platform 33 ft. wide The autogiro has previously been landed on a stationary aircraft carrier of small size by its inventor, Senor de la Cierva but no aircraft has previously attempted take-offs and landings on an ordinary cruiser The autogiro can have the blades of its rotor folded for storage purposes and its value for aerial fighting is now being investigated by the British Air Ministry Naval experts are interested in the experiments because they offer a possible means of increasing the availability of ordinary naval vessels as aircraft carriers

Contract awards

The Development section of the Bureau of Air Commerce has contracted with Waldo D Waterman of Los Angeles to construct a tailless airplane in accordance with plans and specifications submitted several months ago The Bureau will carry on experimental and service tests with the plane to determine its suitability as a private-owner ship Numerous other designs are also being considered by the Bureau in their search for a safe, economical airplane of such simplicity of construction as to make it readily adaptable to quantity production

The Bureau of Aeronautics Navy Department has awarded to the Pratt & Whitney Aircraft Company a contract of $1,138,831 for engines and spare parts. Included in the purchase are 201 engines of Type R-1340-12

For the completion of barracks at the Marine flying field at Quantico, Va., the Bureau of Yards and Docks awarded an $84 750 contract to W P Thurston Company Richmond, Va

Contracts recently awarded by the Army Air Corps include one of $65 000 for 25 000 mica type spark plugs to the B. G Corporation, New York City.

The Public Works Administration has allotted $20,000 to the Bureau of Air Commerce to complete a project for the combining of radio facilities so as to provide for standby equipment at 57 places With the additional funds the Bureau plans to install fifth tower antennas at Albuquerque, Boston, Fort Worth, Kansas City, Los Angeles, Oakland and Omaha A set of four tower antenna masts will be constructed and installed at Buffalo

Bendix Aviation Corporation has recently acquired as one of its subsidiaries the Zenith-Detroit Corporation to be known hereafter as the Zenith Carburetor Company Zenith will take over the distribution of Bendix-Stromberg products in Europe

Airship inquiries

Following the loss of the Macon in the Pacific 110 miles south of San Francisco Feb 12, Rear-Adm J M Reeves, commander-in-chief of the U S Fleet, convened a Naval Court of Inquiry consisting of Judge Advocate C. L. Gatch, Rear-Adm O G Murfin, Capt. V R Van Auken, and Capt H E Shoemaker At hearings on board the U S S Tennessee in San Francisco Harbor, testimony was presented which indicated that structural failure probably occurred at the point of attachment of the tail surfaces causing rupture of gas cells in the stern.

Meanwhile Secretary of the Navy Swanson announced that he had written Dr Karl T. Compton, president of the Massachusetts Institute of Technology and chairman of the Science Advisory Board, requesting the board to appoint a suitable committee to review and analyze the rigid airship situation, past and present, and to make recommendations for the future

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PROF. HUGO JUNKERS, one of the earliest constructors of aircraft and designer of all-metal monoplanes and Diesel engines, died in Munich Feb 3 at the age of 76 He designed the Junkers heavy oil compression ignition engine for aircraft, an opposed piston type, and was also responsible as far back as 1909 for the design and development of all-metal airplane construction involving the use of thick cantilever wings In the years of commercial aviation activity immediately following the World War, Junkers planes began to be widely used by European and American airlines In 1921 Professor Junkers founded the Junkers Luftverkehr A.G., at that time the largest air transport system in Germany.

AVIATION PEOPLE

• Vice-president and general manager of Curtiss Aeroplane & Motor Company of Buffalo since June, 1934, RALPH S. DAMON has been made its president Since his connection with the Curtiss Company in 1922, he has served respectively as factory manager, vice president, and general manager of Curtiss-Robertson Manufacturing Co., vice president and general manager of Keystone Aircraft Corporation, and president of Curtiss-Wright Airplane Company (of St Louis), which latter post he still retains Mr Damon succeeds J A B SMITH, who remains executive vice president and treasurer of Curtiss-Wright Corporation

• JAMES M GERSCHLER has been appointed assistant chief engineer of Lockheed Aircraft Corporation, having served in the engineering department and contributed toward the design of the Sirius, Orion, Altair and Electra

• One treatise, "Cowling and Cooling of Aircraft Engines," took both the medals awarded annually by the Society of Automotive Engineers for outstanding technical papers in the field of aeronautics in 1934,—the Wright Brothers Medal for excellence in airplane design and research, the Manly Memorial Medal for aircraft engine design. The authors are REX B BEISEL, assistant chief engineer of Chance Vought Corporation; A LEWIS MACCLAIN, chief test pilot, Pratt Whitney Aircraft Company; and F H. THOMAS, research division of United Aircraft Corporation

• Two marked honors were recently conferred on DR JOSEPH S AMES, president of Johns Hopkins Honorary Fellowship in the Institute of the Aeronautical Sciences, and the Langley Gold Medal of the Smithsonian Institute The latter is in recognition of his chairmanship of the National Advisory Committee for Aeronautics, and his selection as Honorary Fellow was determined by his "able direction of aeronautical research"

• The Bureau of Air Commerce has appointed ROY KEELEY inspector for South America, where he will study the operation of American-operated air lines and supervise licensing Mr Keeley has been on the Bureau's staff since 1931 and has to his credit 6,000 hours of flying time

• W B KINNER, president of Security National Aircraft Corporation announces the election of JAMES A PHILLIPS, JR as a vice president and director, and HUGH H GREEN as treasurer and director Mr Green for several years with the Curtiss-Wright Flying Service, fills the vacancy created by the resignation of A W HUTCHINSON, who remains as auditor

• Fiske Brothers Refining Company of New York, in acquiring the manufacturing and sales rights of Lubriplate lubricants, has established a Lubriplate Division of which ROBERT L WATTS, identified with Lubriplate since its introduction in this country, is general manager. R L. GARDNER, also connected with Lubriplate for several years, is sales manager

• The Bureau of Air Commerce announces that Dr. CLARA REGINA GROSS has been designated a medical examiner in New York City She will conduct physical examinations for women candidates for pilot's license at her office, 121 East 60th Street.

• ALFREDO ELIAS CALLES, son of Mexico's General Calles, has been made manager of Lineas Aereas Occidentales, S.A., a subsidiary of Varney Speed Lines, which follows the west coast of Mexico from Los Angeles to Guatemala.

• Timken Roller Bearing Company announces the appointment of WHITELY B MOORE as general manager of the industrial division with JOHN L YOUNG as assistant general manager

• EARL HEAVNER, six years with the Boeing Company, Seattle, and more recently with the Northrop Company at Inglewood, Cal., has been placed in charge of manufacturers' sales of Air Associates at Roosevelt Field, Long Island

• The Commercial Air Transport and Manufacturers Association of Canada has elected R. J MOFFETT of Montreal as president, G A THOMPSON of Winnipeg as vice-president. The association will maintain its head office in Montreal.

• The International Technical Committee of Aerial Legal Experts has named DENIS MULLIGAN to take the place of the late RICHARD S PAULETT as American member Mr Mulligan comes to the post from the Bureau of Air Commerce, where he was Chief of the Enforcement Section

• In assuming the position of vice-president and general manager of Gulf Airways, Inc, FLOYD BYRAM has accepted the task of supervising an exten-

sive expansion of the company's operations in the near future. Mr Byram was previously a division manager for Eastern Air Transport, Inc., and continues as president of New York Airways, Inc.

• Caterpillar Club's first woman member, FAY GILLIS, who during a four years' residence in Russia has had an excellent opportunity to observe at first-hand that country's progress in aeronautics, recently returned to become associate editor of *Airwoman*, which succeeds *The Ninety-Niner* as official organ of the Ninety-Nine Club.

• Sales Manager W. A. NUGENT for twenty years connected with The Independent Pneumatic Tool Company, has been elected vice-president in charge of sales. NEIL C. HURLEY, JR., in charge of distribution of the company's electrical tools has been made secretary.

• At the annual banquet of the Tucson chapter of the National Aeronautic Association, the following new officers were installed: PETE WAGGONER, president; JAMES VEASE vice-president; JERRY COE secretary; and KIRKE T. MOORE, district governor. ALLEN L. STEPHENS is retiring president. Congresswoman ISABELLA GREENWAY was the principal speaker.

• LT.-COMDR. RALPH S. BARNABY, assembly and repair officer at Pensacola Naval Air Station and in charge of the Navy's gliding experiments there, was elected president of the Soaring Society of America, to succeed the late WARREN E. EATON. DR. WOLFGANG KLEMPERER, research engineer for Goodyear Zeppelin Co., and RICHARD C. DUPONT, holder of American altitude and distance records, were renamed vice-presidents. LEWIN B. BARRINGER of Philadelphia is the new secretary-treasurer.

• Wing Commanders of the new GHQ Air Force are LT. COL. H. A. ARNOLD first wing, West Coast; LT. COL. H. C. PRATT, second wing, East Coast; LT. COL. G. C. BRANT, third wing, Central States. Lt. Cols. Arnold and Pratt have been made temporary brigadier generals. Lt. Col. Brant receiving the temporary rank of colonel. LT. COL. F. M. ANDREWS commander of the force, also ranks as brigadier general. Another recently announced temporary promotion was that of LT. COL. A. W. ROBINS to brigadier general. He has been assigned to Wright Field in charge of the Air Corps Materiel Division as Assistant Chief of the Air Corps, succeeding General Pratt.

• Advancement of HAROLD CRARY to vice-presidency of United Air Lines follows closely his appointment as advertising and public relations manager of that company (AVIATION, January, 1935). Originally a newspaper man, Mr. Crary's first connection with aeronautics was as manager of the American Air Transport Association in Chicago in 1928. Since 1929 he has been associated with United Air Lines or its predecessor companies.

• Expansion of Braniff Airways, Inc., has added to its staff WILLIAM SALATHE, former aviation editor of San Antonio (Texas) *Evening News*, as publicity and advertising director, NICHOLAS CRAIG of Chicago as traffic manager, and D. C. WALBRIDE, former TWA dispatcher at Kansas City, as operations manager, with headquarters at Dallas, Tex.

Charles H. Chatfield

Lt.-Comdr. Ralph S. Barnaby

John C. Nulsen

Harold Crary

Eugene E. Wilson

• New president of Society of Automotive Engineers is WILLIAM B. STOUT, founder of Stout Engineering Laboratories, and in 1922 of Stout Metal Airplane Co., later sold to Ford Motor Co. Also inaugurated Stout Air Services in 1926 which was purchased by United Aircraft & Transport Co. CHARLES H. CHATFIELD, chairman of Technical Advisory Committee of United Aircraft Corporation, has been elected vice-president for aircraft. He served with the Navy's Bureau of Aeronautics at its formation, subsequently as engineer with Wright Aeronautical Corporation, as associate professor of aeronautics at M.I.T., and as engineer with Pratt & Whitney Company. P. B. TAYLOR, for the past several years chief engineer of Wright Aeronautical Corporation, is the new vice-president for the aircraft power plant activities.

• All publicity for American Airlines, Inc., has been turned over to P. P. Willis Corporation of Chicago, to be under the direction of WILLIAM J. DUNN, formerly with American Airlines' publicity department. He will be assisted by Miss PAT O'MALLEY, HARRY MAYNARD, and RICHARD SMITH.

• JOHN C. NULSEN has been appointed vice-president and general manager of Lambert Aircraft Corporation (formerly Monocoupe Corporation). Vice-president and general manager of B. F. Mahoney Aircraft Corporation at its organization in 1928, Mr. Nulsen served as manager of that company after its sale to Detroit Aircraft Corporation.

• Eastern Air Lines has named T. G. WILLIAMSON district traffic manager of its new Chicago office. His four years' service with the company has been as division traffic manager of the Richmond-Atlanta division.

• Additions to the export sales department of Fairchild Aerial Camera Corporation are DON P. WILSON, formerly district traffic manager for United Air Lines at Spokane, and BURNHAM LITCHFIELD, who was vice-president of Island Airways, Nantucket, Mass., and served two years in the traffic department of Pan American-Grace in Peru.

• The Institute of the Aeronautical Sciences has elected as vice-president EUGENE E. WILSON, president of Chance Vought Corporation and vice-president of United Aircraft Corporation. Resigning from the Navy with the rank of Commander in 1930, Mr. Wilson became president of Hamilton-Standard Propeller Company and later president of Sikorsky Aviation Corporation. He is the author of many technical papers, associate fellow of the Royal Aeronautical Society, and member of the Society of Automotive Engineers.

FLYING SERVICES *and* SCHOOLS

OKLAHOMA aviation enthusiasts met with a committee of the State House of Representatives Jan. 29, to confer on a bill to exempt aircraft fuel from the state highway tax. The meeting was held in Oklahoma City under the direction of William O. Coe, author of the bill. It was shown that Oklahoma business loses more than $30,000 annually from airlines which buy fuel to cross Oklahoma, but buy it outside of the state to avoid the tax. In addition to a large attendance from the Oklahoma City Aviation Club, the following persons were present: Ed Hudlow, William Welborn, Earl Fields, Ed Rose and A. M. Harral, all of Tulsa; L. L. Ruppert, Muskogee; and A. M. Alcorn, Bureau of Air Commerce inspector.

• Final arrangements for the purchase of a plane for the Little Rock, Ark., Flying Club were made at a meeting at the Little Rock municipal airport Feb. 11. The club selected a Taylor Cub monoplane and Hugh Barnwell and Walter Beroset, club organizers, were to leave for the factory at Bradford, Pa., to get the new plane. Ground school instruction was started at the Little Rock Boys Club Feb. 12. Members who have enrolled are: Paul Pollack, Herman Hum, A. M. Monk, Harold Means, Charles Pattison, Richard Harrison, G. P. Bilheimer, Jerald Shurgar, Bob Bradford and Ed Durbin.

• Airport officials, weather bureau assistants and others interested in climatic conditions will begin a study of climatology in Columbia University Extension during the spring session under the direction of Vladimar P. de Smitt.

• O. P. Graff and H. E. Wallis, operating the Privateer Engineering Company at Roosevelt Field, New York, have announced that G. J. Goubeaud, former factory foreman of Amphibions, Inc., has become the third partner of the firm.

• A new Ryan S.T. low-wing monoplane has been added to the lineup of training ships of the Ryan School of Aeronautics at San Diego, Cal. Ryan's acquisition of the 140 m.p.h. plane is an indication of the current trend toward faster training equipment. The school has introduced a new twelve months' master mechanics course to be started April 1. One of its important features is a plan whereby the student will be actually employed in a modern aircraft factory during the last three months of training.

• Lionel Kay, manager of Kay Air Transport Company of the municipal airport at Boise, Idaho, has taken over the hangar formerly occupied by the Bennett Flying Service and will continue the present semi-weekly schedules to Atlanta, Idaho. A. A. Bennett plans to establish another company at Idaho Falls carrying freight and passengers into the Teton Basin and other isolated sections of the Idaho-Wyoming border.

• Fifteen delegates from six New England colleges and universities met at Amherst, Mass., Jan. 19, to ratify a constitution proposed by Chairman William D. Strohmeier of Amherst for the formation of the New England Intercollegiate Flying Club. Henry R. Palmer of Brown University was elected president of the new association and William D. Strohmeier was chosen secretary-treasurer. The conference set May 11 as the date for an intercollegiate air meet at the Northampton airport. Among those who attended the meeting were Thomas Foley of Dartmouth, Joseph Garside of the Massachusetts Institute of Technology, Frank Swayze of Harvard, Donald Hood and Randall Barton of Amherst, and Mary Kimball, Judy Corbett and Annis Reed of Smith College.

• A national flying club for undergraduates will be formed at the National Intercollegiate Flying Conference to be held at Washington under the auspices of the NAA April 2 and 3. Final plans for the national college air meet in June will be laid at the meeting.

• A travel service for sportsmen and tourists in the Lower Rio Grande Valley has been inaugurated by Vermilya-Huffman Company (whose headquarters are at Lunken Airport, Cincinnati, at a newly established base at San Benito, Texas). The company not only offers charter service to points in the United States and Mexico but also furnishes servicing and information to pilots who wish to fly their own ships into Mexico for hunting, fishing, or for sightseeing. Flying conditions are good on the Gulf side of the Sierra Madre Mountains and Victoria, Monterey, and Tampico can be easily reached. Situated a few miles from the Mexican border on the U. S. side, and but 12 miles from Brownsville, port of entry for Pan American, the San Benito airport covers 180 acres, is completely fenced and has been equipped with boundary lights and directional beacon by the Bureau of Air Commerce. The company will use a Stinson Air Cab and a Flamingo for charter work and a Kinner Sportster for training.

• The Ryan Aeronautical Company is located at San Diego, Cal., and not at Santa Monica, as was erroneously stated in this department in the January issue.

MEXICAN HOLIDAY

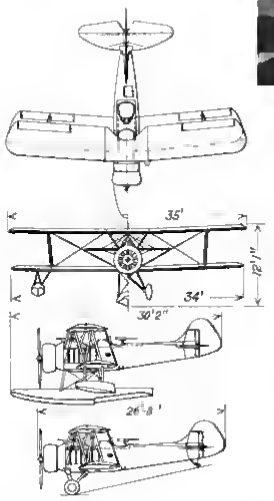
Personnel of the Vermilya-Huffman Company and sportsmen pilots at San Benito, Texas, after a week's hunting and fishing on the Solo La Marina River in Mexico. Left to right: Dr. W. J. Cameron, Chicago; Carl L. Friedlaender, manager of San Benito Field; Dr. D. E. Stewart, Chicago; Tom Colby; Beery Brother representative; E. L. Luke, San Benito; Wright Vermilya. Other directors of the company are Stanley C. Huffman, Walter Friedlaender and Herman Bayless.

FLYING EQUIPMENT

Corsair Junior

THE Chance Vought Corporation has announced the addition of a third Corsair to complete a series which previously has been made up of the V-80 single seater fighter and the V-90 designed for observation, bombardment or attack. The new model to be known as the V-100 is intended for all types of flight training and for a wide mis-

The Corsair Junior as a landplane



cellany of military or naval uses not requiring combat with superior aircraft.

The V-100 is structurally very similar to the other Corsair models though some simplifications have been introduced to save cost and weight. The fuselage is of welded chrome-molybdenum steel tubing. A quickly detachable metal cowling is used forward of the cockpits and a new type of removable fairing has been adopted for the after parts, making it possible to lay bare the entire fuselage for overhaul without damaging any portion of the covering. The wings are of wood, fabric cover with straight rectangular spruce spars and simple wooden ribs. The landing gear is of a rugged oleo-spring type and is, of course, interchangeable with seaplane gear. The empenage is of welded steel tube framework, fabric covered. Either a tail wheel or skid can be mounted.

The engine is the Model S P Wasp Junior, developing 420 hp at 2,200 r.p.m. at 5,000 ft. One of the primary objectives of the design has been to produce a training plane which can be used through a complete graduation of training stages between the primary and that just prior to transition to advanced service types. This is accomplished in the V-100 by "stopping down" the engine to deliver only enough power to accomplish the task in hand. For example, when the training is in the most elementary stages satisfactory flight characteristics can be obtained with but 225 hp. In more advanced stages, more horsepower is made available. The higher first cost of the engine is expected to be considerably offset by the greater reliability and permissable interval between overhauls which characterize running at the reduced outputs. 88 gal. of fuel are carried in the familiar Corsair-type tanks in the sides of the fuselage. Hamilton Standard metal propeller and Eclipse hand inertia starter are standard equipment, while an engine ring cowl is optional.

Without any basic changes the V-100 may be adapted for blind flight training, fixed gunnery, flexible gunnery, photography, light bombing or other secondary military purposes. Of considerable interest is a new type of flexible gun mount for the rear cockpit that has but recently been developed. It is of the combined post and track type and permits ready movement of the gun to any firing position. Its use eliminates the cumbersome and heavy Scarff ring and makes possible a much cleaner and more compact rear cockpit design.

The general specifications and performance of the Corsair Junior landplane, in flight tests, follows:—

Maximum speed at 5 000 ft.	155 m.p.h.
Landing speed	54.5 m.p.h.
Rate of climb (Sea Level to 5 000 ft.)	1 030 ft./min.
Service ceiling	20 500 ft.
Cruising range	564 miles
Weight empty	2 405 lb.
Normal useful load	1 154 lb.
Normal gross weight	3 559 lb.

Lear Radio Compass

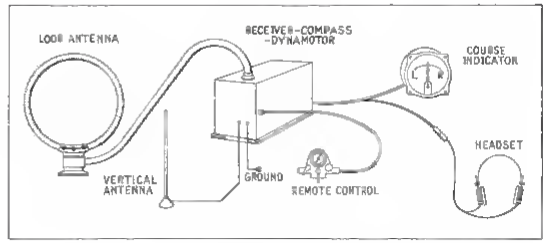
RADIO equipment on board Turner and Pangborn's Boeing 247-D which placed second in the London to Melbourne speed race in October, was designed and built by Lear Developments, Inc., of New York City. Flight operator for the entire trip was Reeder Nichols, who established some amazing records for long-distance contacts during the flight. As an outgrowth of this and other work in aeronautical radio extending back over a number of years, announcement has just been made of a Lear radio compass applicable to all types of commercial and privately owned aircraft.

The Model K compass is a combination radio receiving set and homing device which operates both in the airways beacon and standard radio broadcast frequency channels. For aural indication and for listening to weather reports, broadcasts, etc., a regular receiving head-set is employed. By throwing a switch, a course indicator on the instrument board may be cut in for visual

indication. With a radio compass installation of this type a pilot may take a bearing on any known broadcasting station in the United States. He is then independent of the relatively narrow ranges over the established airways.

The Model K compass is assembled on a single chassis contained in a metal cabinet. Equipment includes the radio receiver, the radio compass circuit, and also the dynamotor which supplies high voltage for the tubes. Primary power is supplied either from a 12- or a 6-volt storage battery. Beside the compass unit proper, there is a streamlined loop antenna assembly which is normally mounted on top of the fuselage or over the pilot's cockpit. The compass receiver cabinet may be located in any convenient part of the ship and the remote control unit brought into the cockpit. Other auxiliary equipment consists of the course indicator for mounting on the instrument board, and the pilot's head-set. For multiple cockpit installations, two or more course indicators may be connected to the same compass unit.

As for specifications, the compass receiver unit including the dynamotor is 6¾ in. wide by 8¾ in. high by 16 in. long. The instrument weighs approximately 30 lb. The loop antenna is 20 in. in diameter, weighs 6 lb. It shows a drag of about 7 lb. at 200 m.p.h. The tuning ranges for the beacon and broadcast receiver are from 200 to 400 kc. and from 550 to 1,500 kc. In addition a high frequency band (2 800 7,200 kc.) is available for head-set reception. The circuit employed is of the superheterodyne type, highly selective, and incorporating automatic volume control.



Schematic layout for Lear Model K Radio Compass. The normal installation in the average ship weighs approximately 40 lb.

New Lightplane

PRODUCTION plans for an interesting new light-weight two place open monoplane to sell in the extreme low priced group has been announced by the National Airplane and Motor Company, a newly organized corporation of Billings, Mont.

Incorporating a car and boom type of fuselage structure it has been designed to have a high degree of stability, a very low landing speed, and to cruise at 75 m.p.h. for a range of 350 miles.

Factory specifications show the Blue Bird to have a gross weight of 900 lb., an empty weight of 452 lb. Its overall span is 36 ft. 3½ in., overall length, 19 ft. 3 in., height 7 ft. 11 in., wing area, 175 sq. ft.

The new Bluebird light two place plane is powered with an engine developing 85 hp. at 2 800 r.p.m. and like the airplane manufactured by the National Aircraft Company of Billings, Montana. Top speed is specified at 85 m.p.h.

The Avro Commodore

Avro Commodore

THE Avro Commodore should appeal to American taste in aircraft, for its striking resemblance to a Waco, if for no other reason. Equipped with a Siddeley Lynx 215 hp. engine it has a top speed of 130 m.p.h. when carrying its gross weight of 3,500 lb. It has really comfortable seats for four and a fifth of the "occasional" type, and its cabin has all the heating, ventilating, safety glass and control features that we have come to expect in a modern design. Its fuselage is of welded steel tubing; its wing structure of steel spars and aluminum ribs.

OPERATOR'S CORNER

An exchange of ideas on the problems of the commercial aviation industry

QUESTION 4: Is there a seasonal lull in your operations during winter months or in bad flying weather? What have you done to obtain business in the slow period? Are there services of a non-aeronautical nature or other forms of work that may be obtained to keep your organization busy in off-seasons?

Planes sell in winter

THERE is usually a lull in our operations during the winter months as there is hardly any passenger carrying, very little student instruction, and scarcely any flying done by the private ship owners.

During this period we devote a good deal of time to repair and overhaul work. We make a periodic inspection of the privately owned ships stored with us and make a list of the repairs we deem necessary. We recommend to the owner that these repairs be done during the period of bad weather and save the inconvenience of having to ground his ship for repairs when there is good flying weather.

We do quite a bit of aerial photography during the spring and summer and we have found the winter months a good time to solicit prospects for this work. Usually the prospect can be signed up at this time and the job done later, during good flying weather. The same applies to the soliciting of students and prospective ship owners. Our record shows that we have sold more airplanes during the winter months than during the spring and summer.

One winter we held evening classes in Ground School, which was not only a financial success but also induced several of the students to take flying instruction. Later, we sold to three of these students new airplanes, which netted a nice profit.

The only venture of a non aeronautical nature which we have ever attempted was to rent hangar space to an automobile dealer, who was overstocked with new cars and had no room for them in his garage. We also acted as salesmen for these cars.—STANLEY W. KECK, *president, Sun-con Valley Skyways, Bethlehem, Pa.*

Make amusement equipment

WHILE flying activities here are affected somewhat by seasonal conditions we do not have the extremely cold winter weather experienced elsewhere, consequently there is some activity the year around. However, it does slack off somewhat during the winter months, but we find this an excellent time to fill the shop with overhaul work. This plan worked admirably during the period of good times but, in the past couple of years, had we been compelled to rely entirely upon the aircraft industry, we probably would have been 'out of the picture" by this time. We have been fortunate in having developed some amusement equipment which we manufacture here in our own shops. This has been instrumental in keeping us alive. It has also acted as a subsidy for our aircraft activities, permitting us to maintain a complete flying service at all times. Now that the industry is on the up-grade again, it appears it will soon be capable of standing upon its own feet.—LEE U. EYERLY, *president, Eyerly Aircraft Corp., Salem, Ore.*

No lull this year

THE usual seasonal lull in flying operations has not manifested itself this year. On the contrary, the volume has shown an increase, apparently due to improved economic conditions. Fortunate climatic conditions present few days when commercial flying activity is suspended in Southern California. As an innovation to attract passenger patronage, we have demonstrated the possibilities of plane-to-terminal communication and vice versa with a short wave set placed near the passenger zone. Efforts have been confined to aeronautical matters rather than others.—EDWARD A. DYCER, *manager, Dycer Flying Service, Inc., Los Angeles, Cal.*

Plane work for bad weather

FIRST, there certainly is a seasonal lull during winter months, and in bad flying weather. So far we have been unable to do very much to obtain business in this slow period. At the present time all the fields around here are snowed in, and it is dangerous to operate even if we could get business. We had planned this winter on making special trips to Florida, and possibly doing some business there, but our plans have not materialized and we doubt if this would be a paying proposition except from the standpoint of possibly keeping pilots busy even if we made no money. We of course always try to have some work on our own planes and on others during these dull periods in winter months, and in bad flying weather.

There seems to be no possibility of work of a non aeronautical nature in our section, except in the sense that we might lay off individuals who might obtain other employment personally. As an organization, however, we do not see how we could pick up such work during the dull season.—E. W. WIGGINS, *E. W. Wiggins Airways, Inc., Providence, R. I.*

Stanley W. Keck

Lee U. Eyerly

E. W. Wiggins

May and June are poor

IN ANSWER to your question No. 3 for the Operator's Corner I will say that there is not much seasonal variation in flying on the Pacific Coast. Our records for the past five years show that the poorest months of the year are May and June, the best months being September, October and November. January, February and March are always good months with us. We do not know quite how to account for the lull that occurs in May and June for we have it every year and it is not due to weather. We usually have only one cold snap during the year and that will last only for a week or so and the temperature will not be much below freezing, so winter is no handicap to us in flying.—A. ELLIOTT MERRILL, *president, Washington Aircraft & Transport Corp., Seattle, Wash.*

Ground activities help

WE EXPERIENCE no seasonal lull as weather conditions here permit of comfortable all year around flying. Naturally we have some days of no flying activity and for that reason have branched out into sales, service and supplies.

It has been said that for every pilot there should be 4 to 6 ground men. This statement can be amplified into the following: For each flying department there should be 4 to 6 ground departments. For this reason we have branched out and are trying to cover more than one field of aviation, by engaging in flying, shop repair, gas and oil sales, ship sales, hangar work and supply parts sales.

We find that seasonable weather conditions do not affect our gross volume whereas seasonal or daily conditions might affect the individual departments.—L. G. MASON, *Montgomery School of Aeronautics, Montgomery, Ala.*

Question 4

(Answers will be published in April)

WHAT are your policies for inspection and servicing of equipment? At what intervals have you found it necessary to overhaul engines, other parts of planes? How do maintenance costs vary for different types of service? What is the usual life of mechanical equipment, i.e., the time when it is more economical to replace than to repair?

Question 5

(Answers will be published in May)

DO YOU consider it advisable to continue your ground school instruction during flight training? Are ground courses economically justified? Have they been found to be successful as producers of students for flying courses? Should they be considered a prerequisite for flight training? Should this expense be absorbed by a charge separate from that for flight instruction or should the cost be included in that of the flight instruction, calling the ground course free? (Submitted by A. Elliott Merrill, president Washington Aircraft & Transport Corporation, Seattle, Wash.)

SIDE SLIPS

By Robert R. Osborn

THE last issue of AVIATION published an announcement which certainly must have brought tears to the eyes of the old-time barnstormers who saw it,—

Through its president, Jack Frye, Transcontinental & Western Air is encouraging the owners of private airplanes to use the servicing facilities available at all airports from which the company operates. Mr. Frye has issued instructions to TWA field managers [illegible] to extend to all private flyers every possible service, including free weather information, routing information, servicing and repairs. Fuel supplies may be purchased without any cash outlay upon presentation of a special private flier's courtesy card issued by the airline, which provides for a billing on the first of the following month."

It is amazing to consider what a short time ago it was necessary for the desperate barnstormer to obtain such supplies and services entirely by his wits and an elastic moral code. One very popular trick was to explain to the unsuspecting garage owner the necessity for filling the Jenny tanks before nightfall "to prevent condensation of the night air," so that one could take off at the crack of dawn. Others preferred the system of explaining to the farmer that his field might make a good semi-permanent base, and one needed a tank of gas to make some "test flights" from the field, or, possibly, one stayed two days of an expected three-day stand, with the farmer supplying the field and gas, but with the mechanic selling the tickets and collecting the money.

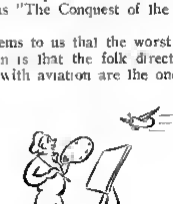
A sad day it was for private flying when the field owner learned to take home with him the magnetos or carburetors of all visiting ships,—but now, with a gas billing on the first of the following month,—can it be that happy days are here again?

ACCORDING to the *Aeroplane*, a Hillman airliner was carrying two passengers, considerable baggage and some boxes of gold bars on a recent trip between Paris and Abridge, Essex, when a severe bump was encountered. On arriving at his destination, the pilot and the owners of the gold were dismayed to find that the gold bars and some of the baggage had bumped a hole through the baggage compartment floor and disappeared. Editor Grey suggests that this might offer a good solution to the gold problem which seems to be the cause of much of the trouble brewing between nations—either to carry all of the stuff around in airplanes with weak baggage compartments,—or else to not actually move any of the stuff from one nation to another, but just pretend it has been moved.

Offhand this solution impresses us as being as logical as any,—certainly as logical as the solution decided on by our own Supreme Court,—which, as we understand it, is that a Government bond holder is entitled to receive gold or its equivalent value,—but he will not be permitted to sue in any court to get it.

The editor of the *Aeroplane* is also considerably concerned because aviation has not inspired any painters, poets, musicians or sculptors to turn out anything which could really be classed as Art. His concern, while long-brewing, was brought to fever-heat by a recent sculpture competition for which the subject was "The Conquest of the Air by Man."

It seems to us that the worst of this situation is that the folk directly connected with aviation are the ones most likely to be inflicted with fearful and awesome works of aeronautical art as gifts—which cannot be thrown away, of course. One devoted aunt presented us with a beautiful set of book-ends commemorating Lindbergh's Paris Flight and showing The Spirit of St. Louis flying into some clouds, with the Tail Skid dolly attached to the skid. A cousin presented us with a beautiful leather desk set, on which was tooled a beautiful picture of a wartime vintage DH, with the ailerons hard over, and the elevators drooping down full throw.



A Studied Operation

THE method which was put into operation at this field after careful study seems to have derided merit. A top notch training plane was selected and after some study the price of solo time was set at $12 per hour. The price at neighboring fields at that time ranged from $5 to $14 per hour solo time.

The planes were equipped with a pressure time clock designed to run in at 40 m.p.h. and run out below that speed. Naturally none of the taxi time was recorded on the clock. The student received a full hour or half-hour of air time. The students were quick to grasp the fact that they were receiving much more value for their money than they were on planes of competitors. Under this method of selling time the average student was ready to solo in 5½ to 6 hours. It was found that our engine time ran from 33⅓ per cent to 50 per cent more than that of the pressure clock time. The loss, however, was when the engine was being run at reduced throttle and reduced to actual dollars and cents it cost two to three gallons of gasoline per hour. A pressure clock avoids any argument as to the amount of time the student has had in the air. It is also very valuable on cross country flights as it records the flying time which the pilot can check with his fuel consumption.—ROBERT C. CODMAN, *Framingham Airport, Framingham, Mass.*

Taxi time one way

WE have found the method of charging for time that sells best to the student is an hourly base rate plus a flat rate for instruction. Regular rates include taxi time one way.—COMMERCIAL AIRCRAFT CO., *Swan Island Airport, Portland, Ore.*

Low cost appeals

WE have found that an hourly charge for flying time is more satisfactory because of the seeming low cost when discussing the subject with the prospective flyer. Allowing a discount on a "block" of ten hours has a certain sales appeal. Due to the arrangement of the Portland Airport we do not make a charge for taxi time.—JAMES L. MEADOWS, *Portland Air Service, Inc., Portland, Ore.*

QUESTION 5: What method of charging for flying time to student instruction have you found to sell best to the student?

THE MAINTENANCE NOTEBOOK

A Shop on Wheels

AIRCRAFT INDUSTRIES, Inc., out at Grand Central Terminal, Glendale, operates an airplane and engine repair station of which readers of this department will hear more later, for this shop, under the supervision of Charles Kidder, is full of ingenious gadgets. Among them is the twenty-hour airplane check bench illustrated. There are plenty of portable work benches in shops about the country, but few are as completely equipped as this one. It is, in fact, a complete shop in itself. On its metal top are a mounted vise, electric grinder and buffer, spark plug racks, pressure spark plug tester, and a power-driven drill press. A bracket supports an overhead light which can be swung into position over any part of the bench. Two metal drawers contain small tools, and racks are provided below for oil cans, parts pans, etc. On a shelf at one end is a magneto tester and synchronizer. A reel is provided for safety wire, a Pyrene fire extinguisher is clipped to one of the legs, and an electric soldering iron is part of the standard equipment. Reeled in back are 150 ft. of heavy duty rubber covered cable to provide electric power to the machine motors, lights, and power outlets on the bench, also 150 ft. of rubber hose for air connections. On its swiveling rubber wheels, the bench can be pushed alongside any ship on the hangar floor.

Charles Hughes, in charge of servicing at Aircraft Industries, Inc., Glendale, Cal., using the portable work bench for a twenty-hour service check on a Kinner Specialist. Note the compressed air connection for spray cleaning and the portable drip pan under the engine.

Safety Device

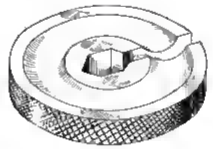
AS the size of airplanes increases, mechanics working on wings and engines perform their labors higher and higher from the ground. Down at Pan American's Dinner Key Base, steps have been taken to avoid injuries to mechanics from slipping and falling from the wings and servicing platforms of the huge Clipper ships. In the servicing hangar when men are sent up onto the upper surfaces of wings to work around the fuel tanks and engine nacelles, they are required to wear the safety harness shown in one of the accompanying pictures. This consists of broad webbing straps made up somewhat after the manner of a parachute harness. In the middle of the back of the harness a piece of stout rope is spliced in. Before doing any work on the upper surfaces of wings, the mechanic must first attach the free end of the rope to some point in the roof trusses overhead. He can then go about his work knowing that if he should slip, he cannot fall all the way to the concrete floor 25 or 30 ft. below.

Safety harness worn by mechanics at Miami when working high up on Clipper wings or engines.

For more extensive operations in the overhaul department, when a number of men are to be put to work on wings and engines, a large rope net similar to those used under trapeze performances in circuses, has been obtained and is stretched across the shop from column to column under the working location. Anyone who happens to slip from wing or servicing platform falls into the rope net without injury.

Spark Plug Harness Wrench

IN a number of shops some damage has been done to couplings between ignition shielding harness and spark plugs when mechanics pulled up too tightly on the coupling nuts. Chief trouble comes from using long-handled wrenches, applying too much leverage. To avoid the difficulty, a special type of wrench has been devised (United Air Lines, Western Air Express, etc.) which is convenient to use in the somewhat close quarters around engine spark plugs and yet which cannot be misused to apply too much pressure to the nut. The device consists simply of a metal disk approximately 2½ in. in diameter and about ½ in. thick, in the center of which a hexagonal opening is cut to fit the coupling nut. A slot of sufficient width to pass over the ignition wiring is milled through to the edge of the disk as shown in the accompanying sketch. The edges of the disk are knurled to prevent slippage. The method of use is obvious. The wrench is slipped in over the harness wiring and the coupling nuts tightened by rotating the disk. The limited leverage prevents overtightening.



A simple spark plug harness wrench which prevents overtightening of engine nuts.

More Uses for Oil Drums

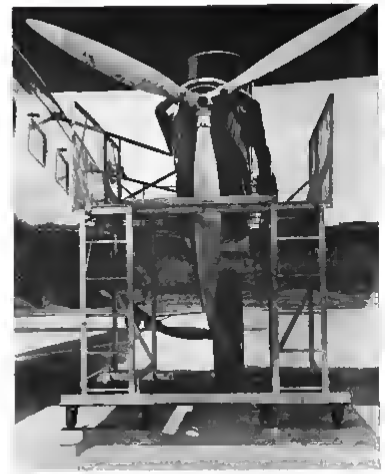
NATIONAL AIR LINES' superintendent of maintenance, Clarence Belinn, makes up a great many useful gadgets out of old oil drums. Readers of the February issue will recall his Varsol reclaimer. We present herewith two other items from Belinn's collection, both used for draining and cleaning operations.

The shallow drain and wash basin has been made up of material from the junk pile, an old gasoline advertising sign base mounted on swiveling casters, four pieces of scrap pipe and a section of an oil drum. The latter is 8 in. deep and makes a convenient shallow basin for washing out small parts in Varsol. Although the height of the outfit shown in the photograph is fixed, it would be very easy to make the supports adjustable by telescoping so that the basin could be put at any convenient height for engine draining or parts cleaning.

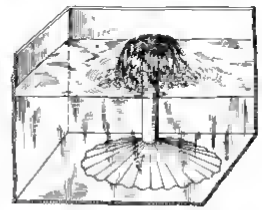
The other half of the barrel which was cut down for the shallow basin was mounted on an angle iron cradle on casters, as shown in the other picture. This makes a portable receptacle for draining engine oil. It can be pushed conveniently under engine sumps and the oil drained into it directly.

Vat Agitator

FOR best results, hot cleaning compound tanks must be kept agitated for uniform temperature distribution and for uniformity of cleaning. One simple method for agitating Magnus cleaning compound is in use at the Fort Worth shops of American Air Lines, where William B. Click is superintendent of maintenance. The device is very similar to the center tube arrangement in the ordinary coffee percolator. It consists of a sheet metal cone about 24 in. in diameter and 3 in. high. A vertical pipe 2 in. in diameter is fitted into the top of the cone and extends up above the surface of the compound in the cleaning tanks. The edges of the cone are crimped to allow for free circulation under it. The device rests on the bottom of the tank over one of the gas burners, and the heated liquid rises in the tube and bubbles out at the top to keep the whole mass in constant circulation.



Portable servicing platform used by Eastern Air Lines at Atlanta.



"Percolator" for agitating hot cleaning compounds in American Air Lines shops at Fort Worth.

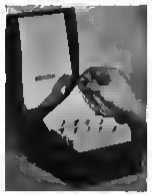
Shallow washing basin and (right) engine oil draining buggy made up by National Airways by cutting a steel oil drum lengthwise.

Condor Servicing Platform

ALTHOUGH the old water-cooled Condors are being replaced with faster and more modern equipment on Eastern Air Lines, the accompanying photograph of a work stand developed at the Atlanta Depot some time ago may give someone an idea which may be applied to other airplanes. Built of angle iron, mounted on swiveling casters, the U-shaped platform may readily be pushed around the nose of the engine nacelles. The wooden top platform with the screened railing provides for the safety and convenience of mechanics working on the engine.

Wright Overhaul Manual

BOOK reviewing is somewhat out of bounds for this particular department, but an exception can logically be made for the new "Overhaul Manual for Wright Cyclone Engines" just published by the Wright Aeronautical Corporation at Paterson, N. J. Although primarily a treatise on the overhaul of the direct and geared Series F Cyclones, the book covers a great many items of interest to anyone maintaining large radial engines. The book may be obtained directly from the engine manufacturer. The price is $5 a copy.



THE BUYERS' LOG BOOK

AVIATION'S *Card Index of New Equipment*

This department is equipped to help readers locate manufacturers of any parts, accessories or materials

MATERIALS — **Lubricating Oil**

Gulf Refining Co.
Gulf Building, Pittsburgh, Pa.

GULFPRIDE Motor Oil, a new lubricant offered to the aviation industry, is made from 100 per cent Pennsylvania crude. This oil is claimed to keep engines cleaner over long periods, hence minimizing need for overhauls, to give greater resistance to heat and oxidation, to have less carbon deposit. This results in quicker starting. Tests indicate that it has an exceptionally flat viscosity-temperature curve.

AVIATION, *March, 1935*

LABORATORY EQUIPMENT — **Oil Tester**

Sperry Products, Inc.,
Manhattan Bridge Plaza, Brooklyn, N. Y.

THE Sperry-Cammen Adher-O-Scope is a device which measures adhesion of oils—i.e. the ability of lubricants to cling to a metal surface. Gives a measurement of the fundamental property of "oiliness." It determines effect of crude source on adhesion, effect of added compounds, difference between residuums and distillates, effect of artificial aging, etc. Bulletin 73 available on request.

AVIATION, *March, 1935*

SHOP EQUIPMENT — **Milling Machine**

Van Norman Machine Tool Co.,
Springfield, Mass.

THE NEW No. 6 miller is especially suited for small shops, being built with hand feeds only. Its cutter-head swivels to mill vertically, longitudinally, or at any angle. Sliding gears and 3-step pulleys, controlled by quick-change shifting levers, provide for 9 speeds, from 80 to 1,450 r.p.m. Knee of machine is of box-type construction, anti-friction bearings throughout. Bulletin available.

AVIATION, *March, 1935*

RADIO — **Airplane Transmitter**

Westinghouse Electric & Mfg. Co.,
East Pittsburgh, Pa.

A NEW aircraft type transmitter (type CH) weighs 15 lb. and will deliver a nominal 75 watts of continuous-wave radio frequency power to the antenna. It operates on frequencies from 333 kc. to 1000 kc. by plug-in coil assemblies. The dynamotor weighs 13½ lb. Primary power from 12 volt airplane storage battery. Set, including dynamotor, totally enclosed in metal case.

AVIATION, *March, 1935*

MISCELLANEOUS — **Blueprint Machine**

Milligan & Wright Co.,
4614 Prospect Ave., Cleveland, O.

A PORTABLE table type blueprinting machine, which utilizes the new Armstrong lamp, prints one 18x24, two 12x18, or four 9x12 prints at one time. The incandescent lamp operates from 110-115 DC or AC lighting circuit without transformer choke coils. Automatic time switch, trays for washing, and special drying board furnished with machine. Operating cost about 2½ cents for 18x24 print.

AVIATION, *March, 1935*

SHOP EQUIPMENT — **Electric Grinder**

Skilsaw, Inc.,
3310 Elston Ave., Chicago, Ill.

AN ELECTRIC hand grinder, whose motor turns up to 18,000 r.p.m., is put up in a molded bakelite case. Useful for grinding in close quarters, where extreme portability is important. Fan cooled motor. Filter detachable for cleaning protects the intake from dust and grit. Operates on AC or DC current, weight 2½ lb. Can be used with large range of sizes and shapes of grinding wheels.

AVIATION, *March, 1935*

AIRPORT EQUIPMENT — **Hangar Light**

General Electric Vapor Lamp Co.,
Hoboken, N. J.

THIS company has developed a high intensity mercury vapor lamp, suitable for high bay lighting in shops and hangars. Each unit produces 14,000 lumens at consumption of 400 watts. The combination of blue light and yellow-green reduces glare and produces the sensation of a whiter light. Vertical mounting, 13 in. overall length, operates on 110 and 220 volt, 60 cycle circuits. Average life 1500 hrs.

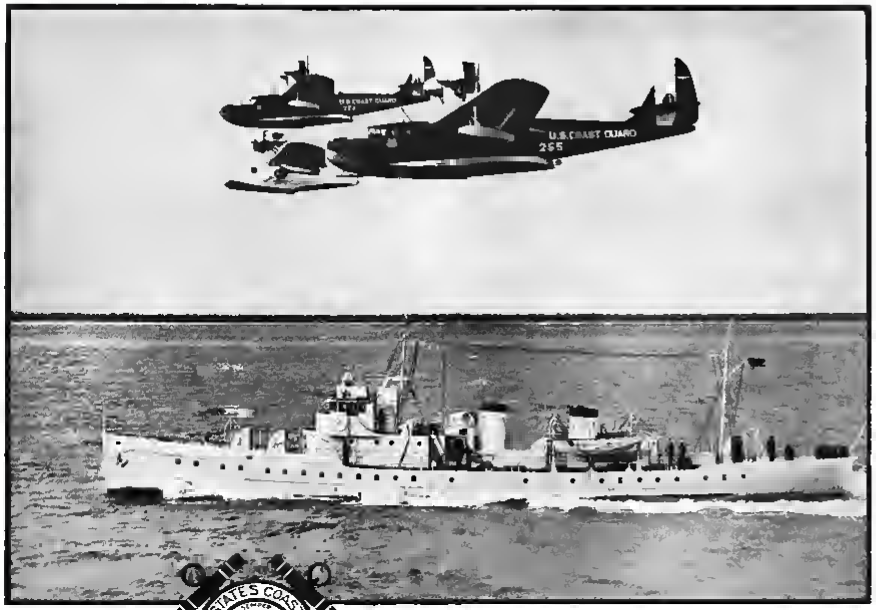
AVIATION, *March, 1935*

SHOP EQUIPMENT — **Spray Apparatus (Cat.)**

Binks Manufacturing Co.,
3114 Carroll Ave., Chicago, Ill.

BULLETIN AD 114 describes and illustrates the Binks line of spray guns for finishing, cleaning, and oiling; cup-type containers, pressure containers, oil-and-water extractors, hose, air regulators, nozzles, compressors, portable spray outfits, spray booths, and exhaust units. 32 pages, 2-color illustrated. Free when requested on business stationery.

AVIATION, *March, 1935*



TO THE COAST GUARD

No record of Coast Guard activities stands out more brilliantly than that of its comparatively new Aviation Branch, which is constantly adding thrilling new chapters to Coast Guard History. Its daring in aiding distressed ships at sea and saving many of those aboard from tragic deaths; transferring medical cases from ship to shore, and from isolated shore points to hospitals; transporting serums and medical supplies, and performing many other human and unusual services possible only to aircraft because of emergency conditions, inspire this respectful tribute *To The Coast Guard*

THE B. G. CORPORATION

Contractors to the United States Army and Navy and Aircraft Engine Builders

136 W. 52nd ST., NEW YORK

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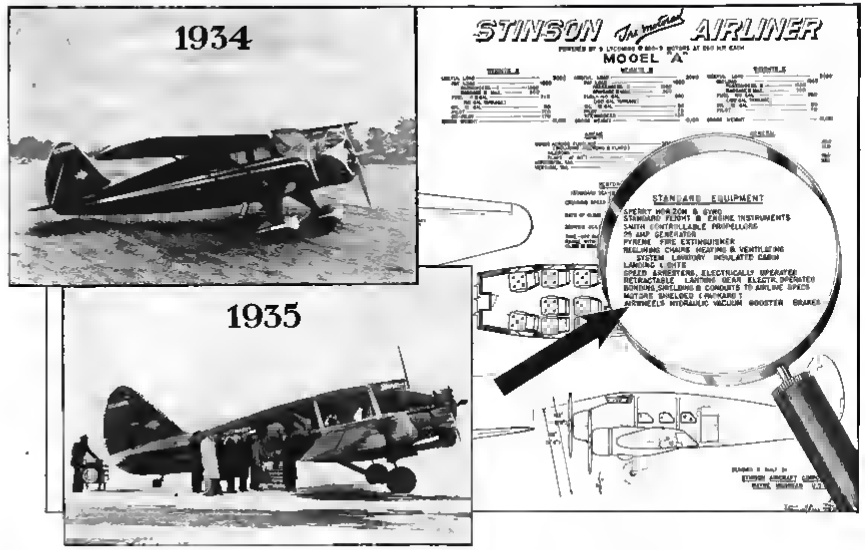


AIRWHEELS* MADE GOOD

on the 1934 Stinson — that's why they are standard equipment for 1935

HERE are three exhibits that tell their own story

Above, at the left, is the Stinson single-engined Reliant model, made in 1934, equipped with Goodyear Airwheels and hydraulic brakes. This model is giving a good account of itself, literally all over the world

Below, at the left, is the latest addition to the line, the new 1935 Stinson—a ten place, tri-motored transport job

And listed in its standard equipment (see above at the right) you will find, "AIRWHEELS, HYDRAULIC VACUUM BOOSTER BRAKES"

That's how these famous soft-landing, safe-landing tires and smooth-action, sure-action brakes have been winning their way on the leading transport planes and lines all over the country.

They make good wherever they're given the opportunity. Isn't it about time you wrote to the Aeronautics Department, Goodyear, Akron, Ohio, or Los Angeles, California, and found out what these tires can do for you?

* IF IT ISN'T A GOODYEAR IT ISN'T AN AIRWHEEL! AIRWHEEL is Goodyear's trade mark registered in the U S A. and throughout the world and is used to denote that Goodyear is the exclusive maker of AIRWHEEL Tires

WHEN YOU BUY A NEW SHIP SPECIFY THE GOODYEAR AIRWHEEL AND THE NEW GOODYEAR HYDRAULIC AIRWHEEL BRAKES

DEPENDABILITY

Rough-water operations conducted by the U. S. Navy have repeatedly established the ruggedness and dependability of Vought Corsairs. Day in and day out, under grueling conditions, the Corsairs have demonstrated their right to serve with the finest naval aviation service in the world.

CHANCE VOUGHT CORPORATION
EAST HARTFORD, CONNECTICUT

E. E. Wilson, President C. J. McCarthy, Vice President

SUBSIDIARY OF UNITED AIRCRAFT CORPORATION

"How I would choose my aviation school—"

"If I were a young man today, how would I go about picking my school? Well, here are the things I would want to know!

"Has it a 'playboy flying school' reputation—or is it known for long hours of intensive, serious work?

"What equipment will I actually work with—in terms of school-owned ships (and their actual horse power), technical library, laboratories and shops?

"Who are the men I will actually study under?

"Is school operated by an actual airline?

"What are its graduates doing?

"How does the U. S. Government rate the school?

"Does it lure students by promising 'to place graduates,' or are they attracted by the type of training that gives a definite edge in the competition for jobs?

Every serious-minded man interested in aviation training will demand the answers to these seven questions from every school he is considering. To borrow or take from savings a sum upwards from $700 is a serious matter. To invest, in addition, many months of a young man's career is a serious matter. Therefore look, and look carefully, before you decide.

Boeing School of Aeronautics will gladly send you its answers to these vital questions. And will answer, frankly and promptly, any others you may wish to ask.

Write for complete description of Boeing School, enrollment requirements, rates and details of monthly payment plan. Mail coupon today for your copy.

BOEING SCHOOL OF AERONAUTICS
DIVISION OF UNITED AIR LINES

The Boeing 40-B (525 h. p. P & W Hornet) is used by Boeing students for landing beam instruction.

It's no coincidence United Air Lines hangars in Oakland, Calif., adjoin Boeing School's. A part of United Air Lines, the school draws upon the world's largest air transport company for practical instruction.

Students assembling a Pratt & Whitney 525 h. p. One of 14 different types thoroughly learned.

NEXT REGULAR ENROLLMENT APRIL 1

BOEING SCHOOL OF AERONAUTICS, Dept. No. 3, Airport, Oakland, California.
Gentlemen: I am interested in the courses indicated:

- ☐ Boeing Airline Pilot
- ☐ Transport Pilot
- ☐ Limited Comm'l Pilot
- ☐ Private Pilot
- ☐ Airline Mechanic
- ☐ Airline Operations
- ☐ Airline Technician (Open to Engineering graduates)
- ☐ Airline Pilot and Operations
- ☐ Special Airline Pilot (For Transport Pilots only)
- ☐ Amateur Pilot

Name _____ Age _____

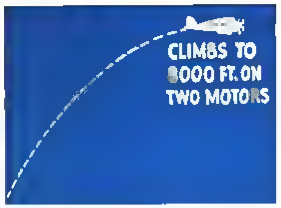
Years in High School _____ Years in College _____ Phone _____

Address _____ City _____ State _____

MASTER OF THE SI HIGH-SPEED RUN

Transcontinental Transport Planes which are most efficient at high altitudes span the nation in four long jumps. The Stinson Airliner delivers its speed at low altitudes and serves the intermediate cities where lie the greatest sources of untapped revenue.

THE STINSON MODEL 'A' AIRLINER* IS THE WORLD'S FASTEST and MOST ECONOMICAL TRIMOTOR



Trimotor Safety

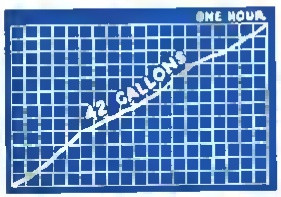
To prove that Pilots need not fear lack of control or climbing power in event of motor failure immediately after take-off, an outboard engine was repeatedly "cut" just after take-off on the fully loaded Stinson Trimotored Airliner. Under perfect control the Stinson climbed to 8,000 feet on the other two engines. This fine performance plus the known reliability of Airline Proven Lycoming Engines is a definite guarantee of safety.

Rapid Climb

Fully loaded, the Stinson Trimotored Airliner will climb to 5,000 feet in five minutes—will climb to 9,000 feet in thirteen minutes and has a service ceiling of 17,000 feet. Pilots and Operators who realize the necessity for rapid climb to rise quickly above unfavorable weather conditions, to cross mountainous terrain or to take off from high altitude fields, will appreciate this performance.

Engineered Silence

Because there is a very definite association between noise and fear, passengers feel safer and more comfortable in "quiet" airplanes. Absence of propeller overlap with all propellers moved well forward of passengers and pilot, plus painstaking planning by acoustical engineers are responsible for the "Engineered Silence" of the Stinson Trimotored Airliner.



Economy

At cruising speeds above 160 miles per hour, attained through use of less than 75% of horsepower, the Stinson Trimotored Airliner uses only 42 gallons of fuel per hour. But gasoline savings are only one of many factors which enabled American Airlines to greatly reduce flight costs per mile through the use of Stinson Airliners. Ask how the Stinson can reduce costs on your Airline.

Saves Time at Terminals

Time saved through rapid handling on the ground is equal to higher speeds in the air. Because the Stinson Airliner was specifically built for runs where frequent stops are necessary, rapid terminal handling was stressed in its design. Airline Pilots who have flown the Stinson are enthusiastic about its quick take-offs, short landing and rapid taxiing ability. Because like Transport Planes, which must climb to addition to these features, passengers and baggage may be loaded simultaneously, the Stinson will save more ground time at Terminals than any other modern multimotored Transport Plane.

High Speed . . . . AT LOW ALTITUDES

service on American Airlines' Detroit-Cleveland run, e Stinson Model "A" Trimotored Airliner* has proven ability to consistently maintain fast schedules and greatly reduce flight costs per mile.

ilt specifically for high-speed, frequent schedule, multi-op runs, the Stinson Airliner is able to deliver cruising eeds of more than 160 miles per hour, and to use its full wer at low altitudes where headwinds e usually less severe.

Operators who must make stops every 0, 200 or 250 miles, these Stinson Airliner eed and economy features are vital. On of this length the fine Transcontinental Transport Planes, which must climb to 000 feet or more to develop their high adwinds, at high altitudes, are at a disadvantage. They are most efficient on long haul runs. Again we repeat that millions of people, who represent millions of dollars in potential revenue, live in scores of Cities on the Transcontinental and the North and South Airlines which are not now served by modern high-speed multimotored planes.

These potential Customers want better service and will pay for it. Until the Stinson Trimotored Airliner was created to serve this great market, there was no plane which the Airline Operator could purchase to meet this need economically.

Now we confidently predict that 1935 will see scores of Stinson Airliners* giving modern airplane service to now neglected Cities and producing much needed revenue for wise Airline Operators.

The Stinson Airliner is also available for the Executive who desires to travel swiftly and comfortably with all the dignity and convenience of his office about him, and for the Hostess who wishes to entertain her guests in a setting comparable to the best interior standards set by fine yacht design.

* The word "AIRLINER" is a part of the REGISTERED TRADEMARK which appears on the fin of every Trimotored Plane built by the Stinson Aircraft Corporation.

STINSON AIRCRAFT CORP. • Wayne, Mich., U. S. A. WORLD'S LARGEST BUILDER OF CABIN PLANES

"SIR CHARLES", TOO,

PROVED THE SAFETY AND STAMINA

OF ROEBLING AIRCRAFT CORD

CONTROLS ON HIS *LOCKHEED ALTAIR*

In commenting on the Roebling Control Cables of Sir Charles Kingsford-Smith's Lockheed Altair, the makers had this to say, following his historic trans-Pacific flight: "Our service department has just checked all control lines carefully and has found the cables to be in good condition, in spite of the severe salt water dousing they had when the Altair swerved into the surf of the Fiji Islands on an attempted take off in a cross wind".

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Tinned Aircraft Wire, 19-wire Aircraft Strand, Tinned or Galvanized, Aircraft Cord (6x7, 7x7, 7x19), Tinned and Galvanized, Ferrules and Thimbles, Serving and Locking Wires, Control Strand and Casing, Electrical Power and Lighting Cables, Gas and Electric Welding Wire.

JOHN A. ROEBLING'S SONS COMPANY, TRENTON, NEW JERSEY

ONLY A FINE PRODUCT MAY JAR **BEAR THE NAME ROEBLING**

On Schedules that reckon time in hours between the far places of the earth, transports equipped with Hamilton Standard Controllables make their appointed rounds of the world's skyways.

★ *On United Airlines a Hamilton Standard Controllable has already passed 3,000 hours aloft. Seventy others have accumulated 2,000 hours each and the average of the entire 114 controllables on United Air Lines transports has passed 2,100 hours.*

To the thousands who daily travel through every type of flying weather—across the varied terrain of both hemispheres—the trademark of the Hamilton Standard Propeller Company is a trustworthy symbol of dependability.

HAMILTON STANDARD PROPELLER COMPANY
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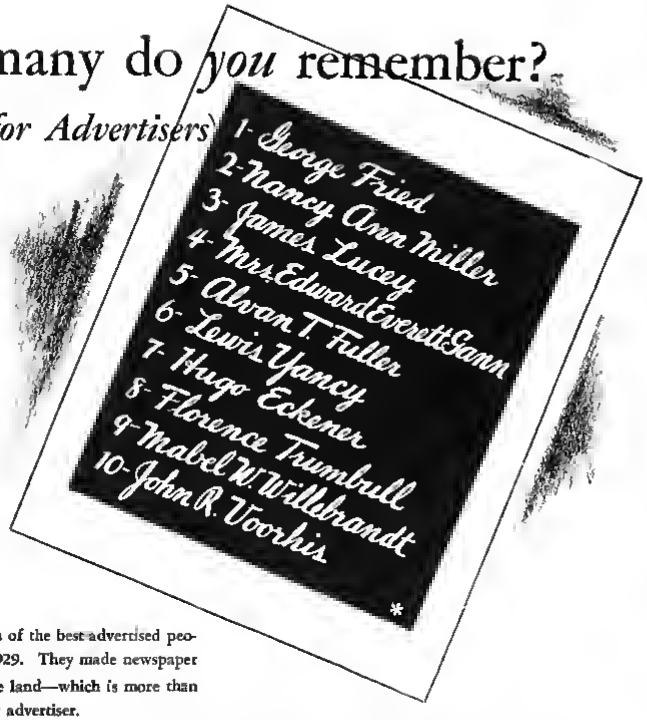
SUBSIDIARY OF UNITED AIRCRAFT CORPORATION

How many do *you* remember?

(*A Lesson for Advertisers*)



ABOVE are listed ten of the best-advertised people of the year 1929. They made newspaper front pages all over the land—which is more than money can buy for any advertiser.

Yet how many can you identify today?

If your advertising ceased when the New Era passed out, and you're under the impression that your prospects haven't forgotten you, let this be a gentle reminder. Not only have 1929's buyers forgotten what you told them five years ago, but today there's a new crop of buyers who never even saw those sales messages of yours!

If your product is worth selling today, it's worth advertising today. Those who sell to business and industry can do it for a modest sum — if they choose the "waste-proof way"—through McGraw-Hill Publications. Here you pay to reach the men who buy, and only the men who buy, in the worthwhile companies in your field.

Give your product a break, your sales force some inspiration, your competitors some real competition—with consistent advertising in McGraw-Hill publications.

* *Just so they won't keep you awake tonight* — 1. Captain of the S. S. America, who made a thrilling rescue at sea. 2. Seattle girl who married a Hindu Monarch. 3. Neschampeon, Mass., philosopher cobbler and friend of Pres. Coolidge. 4. Sister of Vice-President Curtis. 5. Governess of Massachusetts at time of Sacco-Vanzetti trial. 6. Flier who crossed the Atlantic with Rogers Q. Williams. 7. Commander of the Graf Zeppelin. 8. Was married to John Coolidge. 9. Asst. U. S. Atty. Gen. in charge of prohibition enforcement. 10. 100-year old Grand Sachem of Tammany Society.

MACHINERY
MATERIAL
PARTS
and Accessories for Aircraft Manufacture Operation and Maintenance

AVIATION

EQUIPMENT
ACCESSORIES
SUPPLIES
for Airport Construction Operation and Maintenance

SERVICE SECTION

SEARCHLIGHT SECTION

EMPLOYMENT : BUSINESS : OPPORTUNITIES : EQUIPMENT—USED or RESALE

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TRANSPORT pilot 600 hours on all service types ships, army trained, 28, married, desires any connecting flying or managing airport anywhere, best references. PW-278, Aviation, 330 West 42d Street, New York City.

Part Time Work

HAVE BUSINESS TRIP to make to California. Will deliver a ship there or fly partly there and back for expenses. Eighteen years of flying experience, with best references. PTW-279, Aviation, 330 West 42d Street, New York City.

FOR SALE

Ryan B-1

Very good condition. $900. Trade-ins acceptable. Joe Brant, Middle River, Md.

Beechcraft

Perfect condition. J6-9 Whirlwind engine total 300 hours 90 hours since major. Hamilton adjustable pitch propeller, complete blind flying and navigation instruments, five flares, electric generator, radio and four seat parachutes. Cruising range 1,000 miles at 170 miles per hour cruising speed. Ethyl Gasoline Corporation, Chrysler Building, New York City.

100 Hp Challenger Engine

Late type cam. Just completely overhauled with no time since and in perfect condition. $250. Suffolk Airport, Westhampton Beach, L. I., N. Y.

Midwinter Propeller Sale

OX-5 $10.00. Velie, LeBlonds $10.75. Szekely, Continental $13.00. Fords, Chevrolets $9.95. Air Wheels 7.50-4 $14.00 per set, includes hubs. Bibbs Dept. 9, Ft. Worth, Texas.

Hundreds of Airplanes

$40 up. Crackups, parachutes, motors. Directory with descriptions, owner's price, names and address 20c postpaid. Used Aircraft Directory, Albany, Ohio.

Curtiss Challenger Robin

For Sale—Licensed and in perfect condition. C. E. Fritschle, 7710 Country Club Court, St. Louis, Mo.

Write for New Complete Price List

Warner, Kinner K5, Cirrus, Wright J5 engine parts, instruments and accessories. Ready made covering "Flightex Grade A" for all airplanes. All parts guaranteed in good condition. Used parts purchased. Flat rate on expert instrument repairing with six months guarantee. Aviation Salvage Company, 6711 South Menard Ave., Chicago, Illinois.

For Sale or Trade

35 H P Aeronca Lincoln Sport Plane. A-1 condition. Highest offer. Richard Hirsch, 123a E Lorimier, Cape Girardeau, Mo.

PROPOSALS

U. S. Government

WAR DEPARTMENT, Office of the Contracting Officer, Air Corps, Materiel Division, Wright Field, Dayton, Ohio, January 6, 1935. To Airplane Designers and Manufacturers. The War Department invites the submission in competition by sealed communications of new designs covering Bombardment Airplanes, together with statement of price for which any such design in whole or in part will be sold to the Government. Communications containing designs and prices therefor must be submitted to the Contracting Officer, Wright Field, Dayton, Ohio, not later than May 6, 1935, no communication received after 2:00 P. M. Eastern Standard Time, on said date shall be considered. Winner or winners of this competition will be determined as provided in the Act of July 2, 1926 (44 Stat. 780). The Government will require not to exceed fifteen (15) of the type of airplane referred to and will reserve the right to contract with a winner of the design competition for the construction of said airplanes, in the event that said winner is qualified to manufacture same. A copy of the Circular Proposal covering this design competition and containing instructions in regard thereto will be furnished upon application therefor to the Contracting Officer, Wright Field, Dayton, Ohio.

WAR DEPARTMENT, Office of the Contracting Officer, Air Corps, Materiel Division, Wright Field, Dayton, Ohio, January 15, 1935. To Airplane Designers and Manufacturers.—The War Department invites the submission in competition by sealed communications of new designs covering Single-Place Pursuit Airplanes together with statement of price for which any such design in whole or in part will be sold to the Government. Communications containing designs and prices therefor must be submitted to the Contracting Officer, Wright Field, Dayton, Ohio, not later than May 6, 1935, no communications received after 2:00 P. M. Eastern Standard Time on said date shall be considered. Winner or winners of this competition will be determined as provided in the Act of July 2, 1926 (44 Stat. 780). The Government will require not to exceed fifteen (15) of the type of airplane referred to and will reserve the right to contract with a winner of the design competition for the construction of said airplanes, in the event that said winner is qualified to manufacture same. A copy of the Circular Proposal covering this design competition and containing instructions in regard thereto will be furnished upon application therefor to the Contracting Officer, Wright Field, Dayton, Ohio. Park Holland, 1st Lieut., Air Corps, Contracting Officer.

WAR DEPARTMENT, Office of the Contracting Officer, Air Corps, Materiel Division, Wright Field, Dayton, Ohio, January 15, 1935. To Airplane Designers and Manufacturers.—The War Department invites the submission in competition by sealed communications of new designs covering Two-Place Pursuit Airplanes, together with statement of price for which any such design in whole or in part will be sold to the Government. Communications containing designs and prices therefor must be submitted to the Contracting Officer, Wright Field, Dayton, Ohio, not later than May 6, 1935, no communications received after 2:00 P. M. Eastern Standard Time, on said date shall be considered. Winner or winners of this competition will be determined as provided in the Act of July 2, 1926 (44 Stat. 780). The Government will require not to exceed fifteen (15) of the type of airplane referred to and will reserve the right to contract with a winner of the design competition for the construction of said airplanes in the event that said winner is qualified to manufacture same. A copy of the Circular Proposal covering this design competition and containing instructions in regard thereto will be furnished upon application therefor to the Contracting Officer, Wright Field, Dayton, Ohio. Park Holland, 1st Lieut., Air Corps, Contracting Officer.

WAR DEPARTMENT, Office of the Contracting Officer, Air Corps, Materiel Division, Wright Field, Dayton, Ohio, January 15, 1935. To Airplane Designers and Manufacturers.—The War Department invites the submission in competition by sealed communications of new designs covering Observation Airplanes, together with statement of price for which any such design in whole or in part will be sold to the Government. Communications containing designs and prices therefor must be submitted to the Contracting Officer, Wright Field, Dayton, Ohio, not later than May 6, 1935, no communications received after 2:00 P. M. Eastern Standard Time, on said date shall be considered. Winner or winners of this competition will be determined as provided in the Act of July 2, 1926 (44 Stat. 780). The Government will require not to exceed fifteen (15) of the type of airplane referred to and will reserve the right to contract with a winner of the design competition for the construction of said airplanes in the event that said winner is qualified to manufacture same. A copy of the Circular Proposal covering this design competition and containing instructions in regard thereto will be furnished upon application therefor to the Contracting Officer, Wright Field, Dayton, Ohio. Park Holland, 1st Lieut., Air Corps, Contracting Officer.

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WANTED

Will pay cash for Fairchild Airplane, either model 71 or FC-2W2 in good condition, no crackups. Give complete details.

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Complete mechanic and flying courses at special rates in Gov't approved school. Write for complete details.

FOR SALE 85 certified used planes, engines, equipment—we have your needs.
Free storage on planes left for sale.
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FEDERAL AIR SERVICE, HANGAR "B"
Roosevelt Field, Mineola, L. I., N. Y.

FOR SALE

BELLANCA

CH300 SPCLM J-6 300, Dual Controls, Standard instruments and accessories. Price complete, $3,300.00, less Engine $1,750.00. Airplane with factory overhaul and recovered suitable for J-5 or J-6 Engine, $[illegible]

BELLANCA AIRCRAFT CORPORATION
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LIBERTY	400 H. P.
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THE STEARMAN AIRCRAFT CO.
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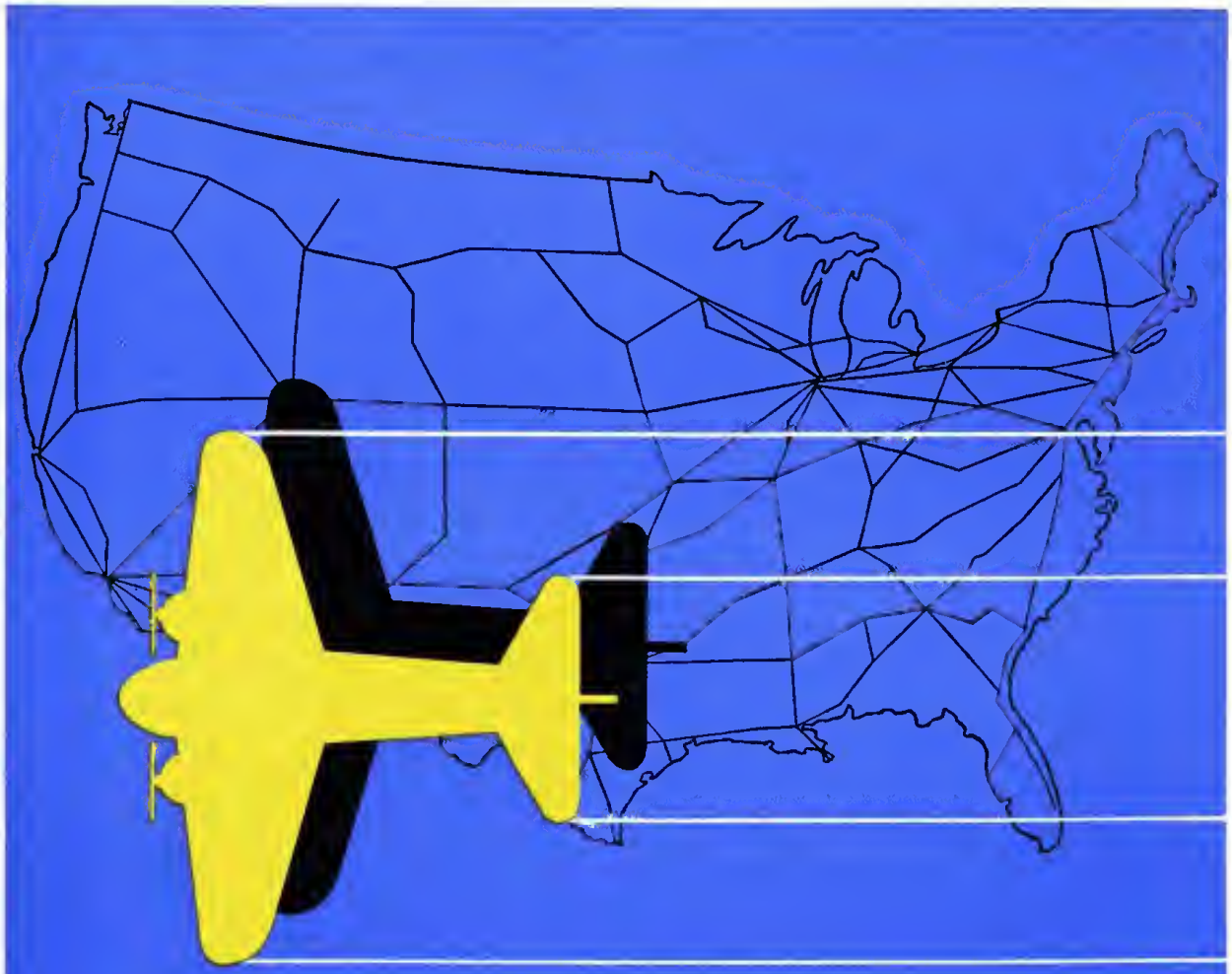

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